USDA

UNITED STATES
DEPARTMENT OF
AGRICULTURE

ANIMAL AND
PLANT HEALTH
INSPECTION
SERVICE

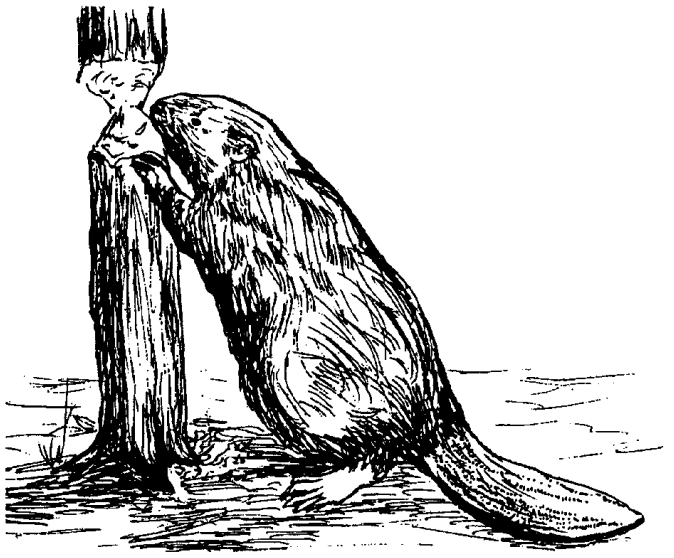
WILDLIFE
SERVICES

in cooperation
with

TEXAS
COOPERATIVE
EXTENSION-
WILDLIFE
SERVICES,

THE TEXAS A&M
UNIVERSITY
SYSTEM

ENVIRONMENTAL ASSESSMENT



AQUATIC MAMMAL DAMAGE MANAGEMENT IN TEXAS

MARCH 2004

ENVIRONMENTAL ASSESSMENT

AQUATIC MAMMAL DAMAGE MANAGEMENT IN TEXAS

Prepared By:

UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
WILDLIFE SERVICES

In Cooperation With:

TEXAS COOPERATIVE EXTENSION-WILDLIFE SERVICES,
THE TEXAS A&M UNIVERSITY SYSTEM

In Partnership With:

TEXAS PARKS AND WILDLIFE DEPARTMENT

U.S. FISH AND WILDLIFE SERVICE

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

U.S. ARMY CORPS OF ENGINEERS

MARCH 2004

TABLE OF CONTENTS

CHAPTER 1: PURPOSE AND NEED FOR ACTION 1
1.1 INTRODUCTION 1
1.1.1 The Texas WS Program 2
1.2 PURPOSE 4
1.3 NEED FOR ACTION 4
1.3.1 Beaver 6
1.3.2 Nutria 7
1.3.3 Muskrat 8
1.3.4 River Otter 8
1.4 PROPOSED ACTION 9
1.5 RELATIONSHIP OF THIS EA TO OTHER ENVIRONMENTAL DOCUMENTS 9
1.5.1 WS Programmatic EIS 9
1.6 DECISIONS TO BE MADE 9
1.7 SCOPE OF THIS EA ANALYSIS 10
1.7.1 Actions Analyzed 10
1.7.2 Native American Lands and Tribes 10
1.7.3 Federal Lands 10
1.7.4 Period for Which This EA is Valid 10
1.7.5 Site Specificity 10
1.7.6 Interdisciplinary Development of the EA 11
1.8 AUTHORITY AND COMPLIANCE 11
1.8.1 Authority of Federal and State Agencies to Conduct AMDM 11
1.8.1.1 WS Legislative Authority 11
1.8.1.2 Texas Cooperative Extension 12
1.8.1.3 U.S. Fish and Wildlife Service 12
1.8.1.4 Texas Parks and Wildlife Department 12
1.8.1.5 Texas Department of Agriculture 12
1.8.1.6 Texas Commission on Environmental Quality 12
1.8.1.7 Natural Resources Conservation Service 12
1.8.1.8 U.S. Army Corps of Engineers 12
1.8.1.9 U.S. Environmental Protection Agency 12
1.8.2 Compliance with Federal Laws and Executive Orders 13
1.8.2.1 National Environmental Policy Act 13
1.8.2.2 Endangered Species Act 13
1.8.2.3 Migratory Bird Treaty Act 13
1.8.2.4 Clean Water Act (Section 404) 13
1.8.2.5 Fish and Wildlife Coordination Act 14
1.8.2.6 Food Security Act 14
1.8.2.7 Federal Insecticide, Fungicide, and Rodenticide Act 14
1.8.2.8 National Historic Preservation Act 14
1.8.2.9 Native American Graves Protection and Repatriation Act 14
1.8.2.10 Executive Orders 11988 and 11990 14
1.8.2.11 Environmental Justice and Executive Order 12898 15
1.8.2.12 Protection of Children from Environmental Health and Safety Risks 15
1.8.2.13 Invasive Species 15
1.8.3 Compliance with State Laws 16
1.9 A PREVIEW OF THE REMAINING CHAPTERS 16

CHAPTER 2: ISSUES 17
2.1 ISSUES CONSIDERED 17
2.2 ISSUES USED TO DEVELOP MITIGATION 17

2.2.1 Effects on Nontarget Species Populations, Including T&E Species 17
2.2.2 Humaneness of Methods Used by TWSP 18
2.2.3 Effects of Beaver Dam Removal on Wetland Wildlife Habitat 20
2.2.4 Effects of AMDM Methods on Public Safety 22
2.3 ISSUES NOT CONSIDERED IN DETAIL WITH RATIONALE 22
2.3.1 TWSP's Impact on Biodiversity 22
2.3.2 Wildlife Damage Should be an Accepted Loss - a Threshold Should Be Reached Before Providing AMDM Services 22
2.3.3 Wildlife Damage Management Should Be Fee Based and Not a Taxpayer Expense ... 22
2.3.4 Public Concern About the Use of Chemicals 23
2.3.5 Appropriateness of Geographic Scope, Statewide 23
2.3.6 Concerns That the Proposed Action May Be "Highly Controversial" and Its Effects May Be "Highly Uncertain", Both Requiring an EIS Be Prepared 23
2.3.7 Impacts of Limiting Aquatic Mammal Numbers on the Public's Aesthetic Enjoyment . 24

CHAPTER 3: ALTERNATIVES INCLUDING THE PROPOSED ACTION 25
3.1 ALTERNATIVES ANALYZED IN DETAIL 25
3.1.1 Alternative 1 - Continue the Current Federal AMDM Program (the Proposed Action) . 25
3.1.2 Alternative 3 - Technical Assistance Only 25
3.1.3 Alternative 4 - Nonlethal AMDM Only 25
3.2 DESCRIPTION OF THE ALTERNATIVES 25
3.2.1 Alternative 1 - Continue the Current Federal AMDM 25
3.2.1.1 IWDM (Integrated Wildlife Damage Management) 25
3.2.1.2 IWDM Strategies that WS Employs 26
3.2.1.3 AMDM Methods 27
3.2.2 Alternative 3 - Technical Assistance Only 36
3.2.3 Alternative 4 - Nonlethal AMDM Only 36
3.3 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE 36
3.3.1 No Federal WS AMDM 36
3.3.2 Compensation for Aquatic Mammal Damage Losses 38
3.3.3 Bounties 38
3.3.4 Eradication and Long Term Population Suppression 39
3.3.5 Reproduction Control 39
3.3.6 Biological Control 39
3.3.7 Nonlethal Required Before Lethal Control 40
3.4 MITIGATION AND SOPs FOR WILDLIFE DAMAGE MANAGEMENT TECHNIQUES .. 40
3.4.1 Mitigation in SOPs 40
3.4.2 Additional Mitigation Specific to the Issues 41
3.4.2.1 Effect on Target Aquatic Mammal Species Populations 41
3.4.2.2 Effect on Nontarget Species Populations Including T&E Species 41
3.4.2.3 Humaneness of Control Techniques 42
3.4.2.4 Effects of Beaver Dam Removal on Wetlands 43
3.4.2.5 Effects of AMDM Methods on Public Safety 43

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES 45
4.1 ENVIRONMENTAL CONSEQUENCES 45
4.1.1 Cumulative and Unavoidable Impacts 45
4.1.2 Nonsignificant Impacts 45
4.1.3 Irreversible and Irretrievable Commitments of Resources 45
4.2 ISSUES ANALYZED IN DETAIL 45
4.2.1 Effects on Target Aquatic Mammal Populations 45
4.2.1.1 Alternative 1 - Continue the Current Federal AMDM Program 46

4.2.1.2 Alternative 2 - Technical Assistance Only 50
4.2.1.3 Alternative 3 - Nonlethal Required Before Lethal Control 50
4.2.2 Effects on Nontarget Species Populations, Including T&E Species. 51
4.2.2.1 Alternative 1 - Continue the Current Federal AMDM Program 51
4.2.2.2 Alternative 2 - Technical Assistance Only 53
4.2.2.3 Alternative 3 - Nonlethal Required Before Lethal Control 53
4.2.3 Humaneness of Control Techniques 53
4.2.3.1 Alternative 1 - Continue the Current Federal AMDM Program 53
4.2.3.2 Alternative 2 - Technical Assistance Only 54
4.2.3.3 Alternative 3 - Nonlethal Required Before Lethal Control 54
4.2.4 Effects of Beaver Dam Removal on Wetland Wildlife Habitat 54
4.2.4.1 Alternative 1 - Continue the Current Federal AMDM Program 54
4.2.4.2 Alternative 2 - Technical Assistance Only 55
4.2.4.3 Alternative 3 - Nonlethal Required Before Lethal Control 55
4.2.5 Effects of AMDM Methods on Public Safety 55
4.2.5.1 Alternative 1 - Continue the Current Federal AMDM Program 55
4.2.5.2 Alternative 2 - Technical Assistance Only 56
4.2.5.3 Alternative 3 - Nonlethal Required Before Lethal Control 56
4.3 ALTERNATIVE IMPACTS 57

CHAPTER 5: LIST OF PREPARERS AND PERSONS CONSULTED 58
5.1 List of Preparers 58
5.2 List of Persons and Agencies Consulted 58
5.3 Literature Cited 58

CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

While all wildlife are a valuable natural resource, some species of wildlife can cause problems with human interests. Aquatic mammals are species that can come into conflict with human interests and sometimes need to be managed to control their damage. The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services[1] (WS) program has personnel with expertise to respond to damage caused by wildlife, including aquatic rodents and otter. Three aquatic mammals, the beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), and otter (*Lutra canadensis*), are part of Texas' wildlife heritage. Another aquatic rodent, the nutria (*Myocastor coypus*), was introduced in the 1930s from South America into Texas.

WS functions as part of a cooperative program within Texas, henceforth known as the Texas Wildlife Services Program (TWSP), and operates under a Memorandum of Understanding (MOU) with Texas Cooperative Extension (Extension), within The Texas A&M University System, and the [redacted]. TWSP receives state legislative support through Senate Bill 198, Chapter 317, Acts of the 52nd Regular Session of the Texas Legislature. This Bill mandates that the State of Texas shall cooperate through the A&M System, with appropriate federal officers and agencies, in controlling animals to protect livestock, food and feed supplies, crops, and rangeland. TWSP conducts these activities through this cooperative relationship as Extension-WS, under the A&M System administration. TWSP is the agency in Texas that has the expertise to respond to the majority of bird damage complaints.

The state Extension-WS and federal WS program cooperate further, through a separate MOU, with the [redacted] that identifies requested services on a more localized basis. [redacted] This MOU also allows for sharing the direct operating costs of providing wildlife damage management services.

In Texas, beaver, muskrat, nutria, and otter are classified as furbearers. Furbearers are protected by State law and the Texas Parks and Wildlife Department (TPWD) is responsible for management of these species. Under State law, though, private landowners or their lessees, public entities or others can take furbearers when these species are a nuisance or causing damage. TWSP is the agency in Texas that responds to aquatic mammal damage complaints. However, TWSP works with TPWD to assist in providing data on harvest so that they can determine management objectives for the different species of aquatic mammals.

The following document is an Environmental Assessment (EA) that describes and analyzes TWSP's involvement in aquatic mammal damage management (AMDM) in Texas. For the purposes of this document aquatic mammals only include beaver, muskrat, nutria, and otter. While TPWD is clearly responsible for managing these species' populations, TWSP is responsible for managing their damage. TWSP assists private landowners and lessees, public entities, Texas agencies, and other federal agencies with AMDM. Being a federal agency, WS must provide analysis to determine impact on the human environment. Therefore, WS is providing the following analysis to determine if TWSP has any significant impacts on the environment. This EA will be used in a decision-making process to determine if TWSP should continue to provide this service or select another alternative that would have less impacts on the human environment. Although

[1] Wildlife Services was previously known as the Animal Damage Control program. The name change became effective in 1997.

TWSP has federal authority to conduct wildlife damage management, TWSP also has a policy of abiding by state laws and has agreed to be consistent with any management direction or plans that TPWD establishes on behalf of the State. TWSP is appropriated funds from the State Legislature to carry out this work under State law. The human environment, with present abundance of aquatic mammals, would likely be the same whether or not WS cooperated with State entities forming TWSP. Personnel that respond to aquatic mammal damage are primarily State employees with federal oversight. AMDM would likely continue in Texas with or without WS involvement, through a different state agency.

1.1.1 Background

Across the United States, wildlife habitat has substantially changed as human populations have expanded and land has been transformed to meet varying human needs. These changes often compete with wildlife and have inherently increased the potential for conflicts between wildlife and people. Some species of wildlife have adapted to and thrive in the presence of humans and the changes that have been made. These species, in particular, are often responsible for the majority of conflicting activities between humans and wildlife. The WS Final Environmental Impact Statement[2] summarizes the relationship in American culture of wildlife values and wildlife damage in this way (USDA 1997):

> *"Wildlife has either positive or negative values, depending on varying human perspectives and circumstances . . . Wildlife generally is regarded as providing economic, recreational and aesthetic benefits . . . , and the mere knowledge that wildlife exists is a positive benefit to many people. However, . . . the activities of some wildlife may result in economic losses to agriculture and damage to property . . . Sensitivity to varying perspectives and values is required to manage the balance between human and wildlife needs. In addressing conflicts, wildlife managers must consider not only the needs of those directly affected by wildlife damage but a range of environmental, sociocultural, and economic considerations as well."*

USDA is directed by law to protect American agriculture and other resources from damage associated with wildlife. The primary statutory authority for WS is the Animal Damage Control Act of 1931 (7 U.S.C. 426-426c; 46 Stat. 1468), as amended in the Fiscal Year 2001 Agriculture Appropriations Bill, which is given in Section 1.8.1.

Wildlife damage management (WDM), or control, is defined as the alleviation of damage or other problems caused by wildlife (Leopold 1933, Berryman 1991, The Wildlife Society 1992). TWSP uses an Integrated WDM (IWDM) approach (sometimes referred to as "Integrated Pest Management") and is described in Volume 4, Chapter 1, pages 1-7 of USDA (1997). This includes nonlethal strategies such as the modification of habitat, the offending animal(s) behavior, or the population, and lethal control strategies of the local population of the offending species.

USDA (1997) contains detailed discussions of potential environmental impacts from methods that are used for WDM in Texas (USDA 1997). The Council on Environmental Quality (CEQ) regulations for implementing the National Environmental Policy Act (NEPA) authorize agencies to eliminate repetitive discussions of issues addressed in programmatic Environmental Impact Statements (EIS) by tiering to the broader documents (CFR (Code of Federal Regulations) 1500.4(I); 1502.20). Thus, this EA incorporates

---

2 The WS Final Environmental Impact Statement will hereinafter be referred to as USDA (1997).

relevant discussions and analysis from USDA (1997). USDA (1997) may be obtained by contacting the USDA, APHIS, WS Operational Support Staff at 4700 River Road, Unit 87, Riverdale, MD 20737-1234.

WS's, and TWSP's, mission developed through a strategic planning process, is to *"provide leadership in wildlife damage management for the protection of America's agricultural, industrial and natural resources, and to safeguard public health and safety"* (USDA 1999). This is accomplished through:

- training of WDM professionals;
- development and improvement of strategies to reduce economic losses and threats to humans from wildlife;
- the collection, evaluation, and dissemination of management information;
- cooperative WDM programs;
- informing and educating the public on how to reduce wildlife damage; and
- providing technical advice and a source for limited-use management materials and equipment such as cage traps.

WS' Policy Manual[3] reflects this mission and provides guidance for engaging in WDM activities. Before WDM is conducted, *Agreements for Control* or *Work Plans* must be executed by TWSP and the land owner, administrator, or agency representative. WS cooperates with land and wildlife management agencies, when appropriate and as requested, to combine efforts to effectively and efficiently resolve wildlife damage problems in compliance with all applicable federal, state, and local laws and MOUs between WS and other agencies.

TWSP responds to aquatic mammal damage throughout Texas. Texas encompasses about 172 million acres statewide. Of this, 4.3 million acres or 2.5 % are covered by permanent water sources in rivers, streams, lakes and reservoirs. The state of Texas has 191,228 miles of streams and rivers contained in 23 major river basins and 5,700 inland reservoirs which comprise over 3 million acres in surface area (Ramos 1999). Statewide, the Natural Resources Conservation Service (NRCS 1994) estimated a total of 8.2 million acres of wetlands. The highest proportion of freshwater wetlands, about half, are in east Texas where beaver and nutria densities are highest and otter is found.

TWSP must have agreements in place to conduct AMDM on properties. As of July 2003, TWSP had active agreements to conduct control on 5,094,835 acres (land and water acreage) for beaver, on 4,079,609 acres for nutria, on 131,892 for otter, and on 833 acres for muskrat. The percentage of these acres where AMDM is conducted is likely much less, because properties under agreement for AMDM usually include all a cooperator's property where wetland portions may only be a small percentage of the agreement. In addition, agreements often have several species listed on them for control including one or more aquatic mammals and other species. This information and other data are kept in a Management Information System (MIS[4]).

---

3 **WS Policy Manual** - Provides guidance for WS personnel to conduct wildlife damage management activities through Directives. WS Directives referenced in this EA can be found in the manual but will not be referenced in the Literature Cited Section.

4 **MIS** - Computer-based Management Information System used by TWSP for tracking WDM activities. The database kept allows queries to be made, retrieving information needed. Throughout the text, MIS data typically will be given by Fiscal Year (FY), which goes from October 1st to September 30th of the following year. MIS reports will not be referenced in the Literature Cited Section (Section 5.3) since most reports from the MIS are not kept on file.

1.2 PURPOSE

This EA analyzes AMDM for the protection of agriculture, property, natural resources, and human health and safety. These problems are resolved on a case-by-case basis. Normally, according to the APHIS procedures for implementing NEPA, individual AMDM actions are categorically excluded (7 CFR 372.5(c), 60 Fed. Reg. 6,000-6,003, 1995). We have decided to prepare this EA to facilitate planning, interagency coordination, and the streamlining of program management, and to clearly communicate with the public the analysis of cumulative impacts.

AMDM is conducted on private, federal, state, county, and municipal lands in Texas. As of June 1, 2003, TWSP had 5,124 active agreements with one or more aquatic mammals listed on them. The percentage of different land classes to conduct AMDM varied by species and was: 65% private lands, 26% county/city lands, 4% military lands, 4% U.S. Forest Service lands, and about 1% State and other federal lands for beaver; 60% private lands, 33% county/city lands, and less than 2% State and other federal lands for nutria, and 100% private lands for otter and muskrats. TWSP has not conducted AMDM on Tribal lands, but could, and these lands will be considered in this document.

1.3 NEED FOR ACTION

The need for action is based on the necessity for a program to protect resources from damage by aquatic mammals. Comprehensive surveys of damage by aquatic mammals in Texas have not been conducted. However, TWSP obtains estimates of the type and value of damage from property and resource owners or managers who request TWSP assistance, or from TWSP personnel that respond to such requests. Damage data thus obtained are summarized for FY00 (Fiscal Year 2000 = October 1, 1999- September 30, 2000) through FY02 in Table 1a for beaver, Table 1b for nutria, and Table 1c for otter. Muskrats did not cause damage from FY00 to FY02, but have in the past. These data represent only a portion of the total damage caused by aquatic mammals, as not all people who experience such damage request assistance from TWSP. Of the 4 species of aquatic mammals found in Texas, beaver are responsible for over 95% of the requests for assistance TWSP receives and 98% of the damage reported to or verified by TWSP.

Table 1a. Value of damage caused by aquatic mammals in Texas as reported to or verified by Wildlife Services in FY00, FY01, and FY02. The damage reported in this table is only a fraction of the actual damage caused by beaver in Texas.

BEAVER DAMAGE IN TEXAS REPORTED BY TWSP IN FY00-FY02							
CATEGORY	SUBCATEGORY	FY00		FY01		FY02	
		Req.	$ Value $	Req.	$ Value $	Req.	$ Value $
Agriculture	Field Crops	4	$5,000	8	$7,400	7	$27,206
	Range/Pasture	83	$174,700	49	$93,980	57	$66,720
	Trees	582	$601,019	412	$529,490	387	$631,150
Natural Resources	Forestry	283	$2,071,025	192	$1,168,700	272	$358,825
	Watershed/Nat. Resource	4	$1,500	-	-	-	-
Property	Landscaping/Turf	264	$283,920	158	$145,209	136	$163,283
	Dikes/Irrigation System	716	$1,684,092	570	$1,151,582	587	$909,675
	Roads/Bridges	233	$431,630	268	$498,883	237	$644,729
	Structures/Utilities	3	$3,600	10	$19,800	8	$9,700
	Other Property	37	$95,700	28	$41,950	18	$34,450
Public Health	Health/Safety	5	$0	5	$0	4	$0
TOTAL		2,214	$5,352,186	1,700	$3,656,994	1,713	$2,845,738

Requests = Requests for assistance

Table 1b. Value of damage caused by nutria in Texas as reported to or verified by Wildlife Services in FY00, FY01, and FY02.

NUTRIA DAMAGE IN TEXAS REPORTED BY TWSP IN FY00-FY02							
CATEGORY	SUBCATEGORY	FY00		FY01		FY02	
		Req.	$ Value $	Req.	$ Value $	Req.	$ Value $
Agriculture	Field Crops/Aquatic Plants	3	$15,150	-	-	-	-
	Range/Pasture	-	-	-	-	2	$5,300
	Trees	4	$6,800	-	-	2	$800
Natural Resources	Forestry	4	$1,225	-	-	-	-
	Watershed/Nat. Resource	-	-	1	$1,000	-	-
Property	Landscaping/Turf	43	$18,575	16	$15,300	20	$20,850
	Dikes/Irrigation System	29	$36,670	17	$11,600	18	$13,400
	Roads/Bridges	3	$200	3	$4,000	-	-
	Structures/Utilities	1	$500	2	$1,200	-	-
	Other Property	5	$1,200	2	$200	3	$1,300
Public Health	Health/Safety	6	$0	8	$75	3	$0
TOTAL		98	$80,320	49	$33,375	48	$41,650

Requests = Requests for assistance

Table 1c. Value of damage caused by otter in Texas as reported to or verified by Wildlife Services in FY00, FY01, and FY02.

RIVER OTTER DAMAGE IN TEXAS REPORTED BY TWSP IN FY00-FY02							
CATEGORY	SUBCATEGORY	FY00		FY01		FY02	
		Req.	$ Value $	Req.	$ Value $	Req.	$ Value $
Agriculture	Aquaculture Fish	11	$1,700	9	$500	5	$1,750
	Aquaculture Shellfish	22	$12,700	13	$6,100	2	$500
Property	Other Property	-	-	-	-	3	$1,000
Public Health	Health/Safety	2	$0	-	-	2	$0
TOTAL		35	$14,400	22	$6,600	12	$3,250

Requests = Requests for assistance

Resource owners and government agencies have used a variety of techniques to reduce aquatic mammal damage. However, all lethal and nonlethal methods developed to date have limitations based on cost, logistics, or effectiveness. The cost effectiveness of the Texas AMDM program has not been determined. However, such a determination has been made in at least one other WS program based on comparing estimates of the amount of damage prevented from occurring with the cost of conducting AMDM. WS in North Carolina (WS 2003) was able to document a 7.1:1 ratio of resource savings per dollar spent for AMDM. This indicates that AMDM as a management tool is highly cost effective for the protection of resources.

To conduct AMDM, it is important to have knowledge about each species. Full accounts of the life histories for these species can be found in numerous mammal reference books. Some background information is given below for each species, especially the information pertaining to their range in Texas.

1.3.1 Beaver

Beavers are part of Texas's wildlife heritage. They probably once occupied suitable habitat in central and eastern Texas and in the Rio Grande River Valley at a maximum carrying capacity prior to European settlement where, at that time, permanent water sources were located. During this era, fluctuations in beaver populations were largely determined by climate (ie., droughts) and plant succession, thus impacting the amount and quality of habitat available. In about 1825, the steel trap was invented enabling trappers to operate with much greater efficiency and fur trapping was at its peak (Seton 1937). By the late 1800's, Texas's beaver population had been severely depleted, with similar trends throughout the West. As a result of the decline, most western states began giving complete protection to beavers starting in 1910. Texas followed in 1925. Once protected, beaver populations experienced steady growth. Aided by reestablishment programs sporadically conducted by TPWD from 1939-1973, beaver slowly recolonized many areas. As populations recovered, reduced restrictions on taking beaver led to a dramatic increase in beaver damage complaints, beginning in the 1960s. Today, beavers are established throughout most of Texas. Additionally, creation of permanent man-made ponds and reservoirs which have increased the surface acres of water in the State, have helped beaver increase their distribution. East Texas populations are considered very high, while moderate elsewhere in Texas. Removal of beaver to resolve damage is now legal throughout the year for landowners or their agents. Thus, once considered an animal near extinction (Seton 1937, Hill 1976, Wesley 1978), the beaver's status changed, and is now often viewed as a pest species in many southeastern states, including Texas (Hill 1976, 1982, Jones and Leopold 2001).

Beaver activities can be beneficial or detrimental depending on the type of activity and location. Opinions and attitudes of individuals, communities, and organizations vary greatly and are primarily influenced and formed by benefits and damage directly experienced by each person or entity (Hill 1982). Habitat modifications from beaver, a result of dam building and tree cutting, can result in positive ecological benefits to other species of wildlife and the watershed (Hill 1976, Reese and Hair 1976). Beaver may increase habitat diversity by flooding and opening forest habitats which result in greater interspersion of successional stages and subsequently increases the floral and faunal diversity of a habitat (Hill 1982, Arner and Hepp 1989). Creation of standing water, edge, and plant diversity, all in close proximity, results in excellent wildlife habitat (Hill 1982). The resulting wetland habitat may be beneficial to some fish, reptiles, amphibians, waterfowl, shorebirds, and furbearers such as muskrats, otter and mink (*Mustela vison*) (Naimen et al. 1986, Miller and Yarrow 1994). However, these modifications can conflict with human resource management objectives and can suppress different species of plants and animals including threatened and endangered (T&E) species. Such conflicts, which are viewed as "damage" by resource owners, result in adverse impacts that often outweigh benefits. Most of the damage caused by beavers is a result of dam building, bank burrowing, tree cutting, or flooding. The value of beaver damage is perhaps greater than that of any other single wildlife species in the United States. In Texas and some southeastern states, losses from beaver damage were estimated to be from $3 to 5 million annually in the early 1990s (Miller and Yarrow 1994), with timber losses being reported as the most common type of damage (Hill 1982). The economic damage was estimated to have exceeded $4 billion in the southeastern U.S. over a 40-year period (Arner and Dubose 1979). Damage throughout the U.S. has significantly increased since that time. TWSP has documented increasing numbers of requests by individuals, especially since the 1980s. Concerns about the increasing beaver damage levels prompted the Texas State Legislature to provide funding for TWSP in 1996, resulting in increased assistance for beaver problems in Texas.

While TWSP saw a steady increase in the value of beaver damage from FY94 to FY00, a decrease was seen in FY01 and FY02 (Figure 1). The number of requests for assistance dropped from FY00 to FY01, but in FY02 requests increased slightly over FY01. Monetary value of damage is a good indicator of the problem, but it is not necessarily the best indicator. The number of requests for assistance typically is a better reflection of the problem. The value of damage can vary greatly from request to request depending on the resource being damaged because some requests alone can result in significant damage as far as value.

Beaver are responsible for a variety of different kinds of damage (Wade and Ramsey 1986, Miller and Yarrow 1994, Willging and Sramek 1989, and Loven 1985). Beaver damage documented by TWSP has averaged about $4 million annually for the last 5 FYs. Most damage types include: (1) building dams that flood cropland and livestock pastures, residential areas, buildings and other property, and forested tracts of lands killing timber; (2) damming irrigation structures and other waterways; (3) flooding roads, railways, and/or adjacent areas resulting in road and railway erosion; and (4) cutting trees, many possessing lumber value, aesthetic qualities and/or importance for stabilizing creek banks. In flat terrain, a relatively small beaver dam may cause hundreds of acres to be flooded.

Beavers can also create damage from other activities (Hill 1982, Woodward 1983, Wade and Ramsey 1986, Miller and Yarrow 1994). Feeding beavers damage and kill trees by gnawing, girdling and cutting. They also feed on agricultural crops. Beavers sometime burrow into man-made dams, levies, or obstruct overflow structures and spillways which can cause such water control structures to fail. Beavers are known to gnaw on or burrow into STYROFOAM® and wood supports under boat houses and docks, requiring expensive repairs. Increased water levels in urban areas resulting from beaver activity can lead to unsanitary conditions and potential health problems by flooding septic systems and sewage treatment facilities (DeAlmeida 1998, Loeb 1994). Contamination of human water supplies by *Giardia lamblia*, a common intestinal parasite associated with beaver, cause outbreaks of giardiasis in humans (Woodward 1983, Beach and McCulloch 1985, Wade and Ramsey 1986, Miller and Yarrow 1994). Additionally, beaver damming activities can create favorable conditions for mosquitoes, increasing insect populations and hindering mosquito control efforts (Wade and Ramsey 1986). While universally considered a nuisance, mosquitoes also transmit potentially fatal human diseases, such as encephalitis (Mallis 1982) or serve as a vector for many fatal domestic animal diseases, such as West Nile Virus in horses and heartworms in dogs and in cats.

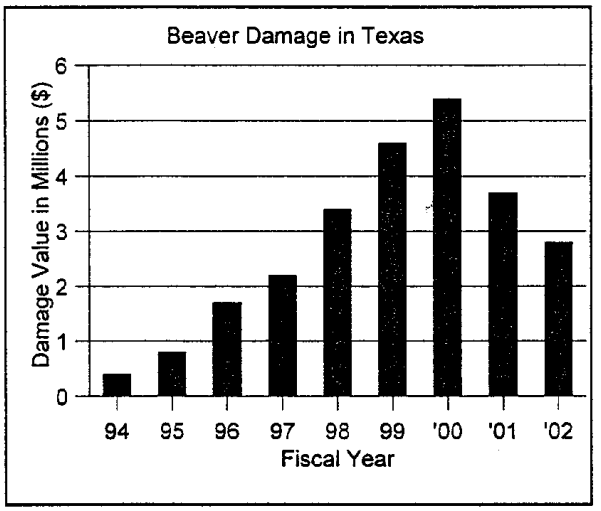


Figure 1. The value of damage from beaver reported to or verified by TWSP Wildlife Specialists from FY94 to FY02.

1.3.2 Nutria

The nutria, a South American aquatic rodent, is not native to North America. During the 1930s and 1940s, they became established in the United States, mostly due to promotion and failure of nutria as a means of

aquatic weed control and nutria "fur ranching" (Kinler et al. 1998; Wade and Ramsey 1986). Currently, nutria range throughout most of the eastern two-thirds of Texas. Their preferred habitat is swamps, marshes, lakes, rivers, and brackish waters where they feed on mostly aquatic and semi-aquatic vegetation, such as cattails and reeds. They also venture from these areas into croplands and golf courses, potentially causing considerable damage (LeBlanc 1994).

Nutria create damage by feeding on agricultural crops such as rice, corn, and other grains, sugar cane and vegetables, and on tree seedlings and ornamental shrubs. Possibly outweighing crop damage, damage to levees built for water control can result in crop flooding and the need for expensive levee repairs (Wade and Ramsey 1986, LeBlanc 1994). Finally, nutria that are hand fed by people can become very aggressive and attack and bite people, especially a passerby that does not feed them. Damage reported to TWSP totaled more than $50,000 annually from FY00 to FY02 (Table 1b). Most nutria damage is not reported to the TWSP, thus, this amount represents only a small portion of the total damage occurring in Texas.

1.3.3 Muskrat

The muskrat is a native North American aquatic rodent. In Texas, muskrats reside along the Gulf coast, northeast Texas, and in the panhandle region. They also occur along the Pecos and Rio Grande Rivers north and west of Big Bend National Park. They do not occur in much of central and west Texas (Wade and Ramsey 1986). Where habitat is suitable, muskrats are generally abundant. They inhabit creeks, rivers, lakes, ponds, and drainage ditches with a steady water level feeding primarily on cattails, bullrushes, and aquatic grasses. It has historically been the most heavily exploited furbearer in North America with 6-20 million harvested annually since about 1935 (Boutin and Birkenholz 1998). Boutin and Birkenholz (1998) provide a comprehensive review of muskrat natural history and population dynamics.

Damage by muskrats is usually not a major problem, but can be significant locally in particular situations (Wade and Ramsey 86). TWSP did not document any muskrat damage from FY00 to FY02, but it has occurred in the past. They typically do not cause as much damage as other aquatic mammals in Texas, but can damage several resources. For example, muskrats often burrow into levees or dams used to hold water causing washouts which result in the loss of irrigation water or other water supplies, and flooding damage where the water drains, depending on the situation (Miller 1994). Muskrats can also damage crops, wetlands, landscaping, natural resources and other resources where these are adjacent to muskrat habitat (Wade and Ramsey 1986, Neves and Odom 1989).

1.3.4 River Otter

River otters are water dwelling members of the weasel family (Mustelidae)and native to North America, including Texas. Being semi-aquatic and carnivorous, otters feed primarily on fish and aquatic crustaceans (primarily crayfish and crabs). They also feed on insects, small mammals, reptiles, and birds (Melquist and Dronkert 1998). They primarily occur in the eastern third of Texas, however, historically their range has extended throughout the eastern half of Texas. Melquist and Dronkert (1998) compiled a comprehensive review of river otter natural history and population dynamics.

While river otter damage is not a major problem in Texas, they can cause serious losses to individuals locally by preying on fish, crayfish, and other types of commercially produced aquaculture products (Hill 1994). In addition, they occasionally can cause property damage or be a general nuisance. Damage attributed to river otter averaged about $8,000 annually from FY00 to FY02 in Texas (Table 1c).

1.4 PROPOSED ACTION

The proposed action is to continue the current TWSP AMDM activities in Texas for the protection of agriculture, property, natural resources, and human health and safety and conduct AMDM activities as necessary to respond to damage levels. The objective of AMDM, as conducted in the proposed action, is to minimize loss or the risk of loss to the above resource categories from aquatic mammals by responding to all requests with technical assistance (advice or demonstrations) or direct control. TWSP employees give technical assistance to resource owners on a variety of methods that can be used to resolve problems for specific situations and where resource owners can handle the problem themselves or where cooperative funds are not available. TWSP will also assist resource owners through educational programs on damage identification and prevention. Direct control support is mostly given with methods that are difficult for the public to implement, especially those that involve lethal control measures, and where cooperative funding is available; resource owners that are given direct control assistance are also encouraged to use additional management strategies when and where appropriate to help reduce present and future problems.

Under the proposed action, IWDM will be implemented which encourages the use of all practical and legal techniques and methods, used singly or in combination, to meet the needs of requesters for resolving conflicts with aquatic mammals. Most wildlife damage situations require professional expertise, an organized control effort, and the use of multiple control methods to sufficiently resolve them; this will be the task of TWSP personnel who are trained professionals and equipped to handle most damage situations. The resource, species, location and type of damage, and all available biologically sound, cost-efficient and legal methods will be considered by TWSP personnel to determine the action taken to correct each conflict with aquatic mammals.

A wide range of legal methods are available to resource owners and TWSP personnel. These fall into different categories including resource management (ie. beaver pond leveler and dam removal), physical exclusion (ie., barriers), and population management (ie. traps, shooting, and toxicants). Population management methods used by TWSP are almost always used lethally. AMDM will be allowed in the State under the proposed action when and where requested on public, private, and Tribal lands where signed *Agreements for Control* or an appropriate Annual Work Plan are in place. All AMDM will comply with federal, state, and local laws and current MOUs between WS and the various management agencies. TWSP personnel will communicate with other agency personnel as appropriate and necessary.

1.5 RELATIONSHIP OF THIS EA TO OTHER ENVIRONMENTAL DOCUMENTS

1.5.1 WS Programmatic EIS. USDA (1997) issued a final EIS and Record of Decision on the USDA-APHIS-WS nationwide program. USDA (1997) did discuss AMDM at the nationwide level and concluded that the nationwide WS program did not impact aquatic mammal populations. This EA is tiered to the EIS and pertinent portions of the EIS are incorporated by reference in this EA.

1.6 DECISION TO BE MADE

Based on agency relationships, MOUs, and legislative authorities, TWSP is the lead agency for this EA, and therefore responsible for the scope, content, and decisions to be made. The U.S. Fish and Wildlife Service (USFWS), the U.S. Army Corps of Engineers (Corps), NRCS, and TPWD have had input during the preparation of this EA to facilitate an interdisciplinary approach in compliance with NEPA, and agency mandates, policies, and regulations.

Based on the scope of this EA, the decisions to be made are:

- Should AMDM, as currently implemented, be continued (the no action alternative)?
- If not, how should TWSP fulfill its legal responsibilities?
- What mitigation measures should be implemented?
- Would the proposal have significant impacts requiring an EIS analysis?

1.7 SCOPE OF THIS EA ANALYSIS

1.7.1 Actions Analyzed

This EA evaluates AMDM to protect agricultural and natural resources, property, and human health and safety from aquatic mammals throughout Texas.

1.7.2 Native American Lands and Tribes

Tribes have not requested TWSP to provide assistance with AMDM in Texas for the protection of resources on tribal lands. If a Tribe contacted TWSP for assistance, the methods employed and potential impacts would be the same as for any private land upon which TWSP could provide service.

1.7.3 Federal Lands

TWSP provides AMDM on federal lands in Texas including USFWS, USFS, Department of Defense, and others. If TWSP were requested to conduct AMDM on federal lands for the protection of private resources, this EA would cover the actions implemented. However, if the request is to protect federal resources, the requesting federal agencies are responsible for NEPA documentation. This EA would cover such actions, though, if the requesting federal agency determined that this EA had an adequate analysis to cover the actions to be implemented. Actions taken on federal lands are included in the analysis in this EA.

1.7.4 Period for which this EA is Valid

This EA will remain valid until TWSP and other appropriate agencies determine that new needs for action, changed conditions, or new alternatives having different environmental effects require a new analysis. At that time, this EA would be supplemented or reissued pursuant to NEPA with the appropriate analyses. Review of the EA will be conducted yearly to ensure that the EA is accurate and sufficient and all AMDM activities have been analyzed in the EA.

1.7.5 Site Specificity

This EA analyzes potential impacts of AMDM and addresses TWSP AMDM activities on all lands under *Cooperative Agreement* or *Agreements For Control* within Texas. It also addresses the impacts of AMDM on areas where additional agreements with TWSP may be written in the reasonably foreseeable future within Texas. Because the proposed action is to continue the current AMDM program, and because the current program's goal and responsibility is to provide service when requested within the constraints of available funding and manpower, it is conceivable that additional AMDM efforts could occur. Thus, this EA anticipates potential expansion and analyzes the impacts of such expanded efforts as part of the current program. This EA emphasizes significant issues as they relate to specific areas whenever possible; however,

the issues that pertain to aquatic mammal damage and resulting management are the same, for the most part, wherever they occur, and are treated as such. The standard WS Decision Model (Slate et al. 1992) and WS Directive 2.105 will be the site-specific procedure for determining methods and strategies to use or recommend for individual actions conducted by TWSP in Texas (See USDA 1997, Chapter 2 and Appendix N for a more complete description of the WS Decision Model and examples of its application). Decisions made using the model will be in accordance with any mitigation and standard operating procedures (SOPs) described herein and adopted or established as part of the decision.

1.7.6 Interdisciplinary Development of the EA

Comments were solicited from the Texas Department of Agriculture, TPWD, USFWS, NRCS, and the Corps. Comments are maintained in an administrative file located at the Texas TWSP State Office, P.O. Box 100410, San Antonio, Texas 78201.

1.8 AUTHORITY AND COMPLIANCE

1.8.1 Authority of Federal[5] and State Agencies to Conduct AMDM

Several Federal and State agencies have regulatory and jurisdictional authority over particular aspects of AMDM. Following are the agencies that have significant roles as they relate to AMDM.

1.8.1.1 WS Legislative Authority. USDA is directed by law and mandated by Congress to protect American agriculture and other resources from damage associated with wildlife. The primary statutory authority for USDA is the Act of March 2, 1931 (7 U.S.C. 426-426c; 46 Stat. 1468), as amended in the Fiscal Year 2001 Agriculture Appropriations Bill, which provides that:

> *"The Secretary of Agriculture may conduct a program of wildlife services with respect to injurious animal species and take any action the Secretary considers necessary in conducting the program. The Secretary shall administer the program in a manner consistent with all of the wildlife services authorities in effect on the day before the date of the enactment of the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2001."*

In 1988, Congress passed the Rural Development, Agriculture, and Related Agencies Appropriations Act which strengthened the Act of March 2, 1931 at that time (the amended Act of March 2, 1931 in 2001 superseded this Act). This Act states, in part:

> *"That hereafter, the Secretary of Agriculture is authorized, except for urban rodent control, to conduct activities and to enter into agreements with States, local jurisdictions, individuals, and public and private agencies, organizations, and institutions in the control of nuisance mammals and birds and those mammal and bird species that are reservoirs for zoonotic diseases, and to deposit any money collected under any such agreement into the appropriation accounts that incur the costs to be available immediately and to remain available until expended for Animal Damage Control activities."*

---

5 Detailed discussions of TWSP legal responsibilities and key legislation pertinent to WDM are found in USDA (1997).

1.8.1.2 Texas Cooperative Extension - Wildlife Services Legislative Authority. The Federal Smith-Lever Act of 1914 (7 USC 341 et seq.) authorizes and provides for the conduct of cooperative extension work in agriculture and related subjects by the land-grant colleges and universities in several states where USDA is cooperating with that state. The Texas Legislature accepted the provisions of this Act in 1915 with the passing of House Concurrent Resolution No. 2 and designated The Texas A&M University System as the institution to receive and administer funds made available under the Smith-Lever Act. Texas Cooperative Extension is an agency within The Texas A&M University System and houses the Extension-WS program. The Legislature authorized the State of Texas to cooperate through the A&M System with the appropriate federal officers and agencies in the control of predatory animals and rodent pests. (Texas Health and Safety Code, Ch. 825, Subch. A).

1.8.1.3 U.S. Fish and Wildlife Service. USFWS has statutory authority to manage Federally listed T&E species through the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531-1543, 87 Stat. 884) and migratory birds under the Migratory Bird Treaty Act of 1918 (16 U. S. C. 703-711; 40 Stat. 755), as amended. TWSP works with USFWS to ensure that WDM activities do not jeopardize T&E species and obtains the necessary permits to conduct migratory bird damage management activities.

1.8.1.4 Texas Parks and Wildlife Department. TPWD has the primary responsibility to protect the State's fish and wildlife resources as directed in the Texas Statutes (Titles 1-7), including aquatic mammals (furbearers). In addition, TPWD has many programs that help protect and manage wetlands and coordinated the development of a Texas Wetlands Conservation Plan.

1.8.1.5 Texas Department of Agriculture. The Texas Department of Agriculture is responsible for regulating pesticide use. TWSP registers pesticides with the Texas Department of Agriculture and has one registration, zinc phosphide, for muskrat and nutria control. TWSP personnel that use restricted-use pesticides in their job duties must become a certified pesticide applicator by the Texas Department of Agriculture to use them, or be supervised by a certified applicator.

1.8.1.6 Texas Commission on Environmental Quality (TCEQ). TCEQ is responsible for implementing much of the Texas Water Code and the federal Clean Water Act. TCEQ reviews applications for Clean Water Act Section 404 permits. They have adopted , for the most part, the identical regulations of the federal Clean Water Act.

1.8.1.7 Natural Resources Conservation Service. NRCS is responsible for making certified wetland determinations/delineations on agricultural lands and at the request of USDA program participants. All wetland determinations/delineations are conducted or verified on-site by properly trained NRCS personnel. County offices of the Farm Services Agency maintains maps of wetlands certified by NRCS.

1.8.1.8 U.S. Army Corps of Engineers. The Corps regulates and permits activities regarding waters of the United States including protection and utilization under Section 404 of the Clean Water Act.

1.8.1.9 U.S. Environmental Protection Agency (EPA). EPA is responsible for administering and enforcing the Section 404 program of the Clean Water Act with the Corps; Section 404 established a permit program for the review and approval of water quality standards that directly impact wetlands. They are also responsible for registering and regulating pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

1.8.2 Compliance with Federal Laws and Executive Orders

Several Federal laws regulate and Executive Orders guide WS and AMDM. TWSP complies with these laws, and consults and cooperates with other agencies as appropriate.

1.8.2.1 National Environmental Policy Act (NEPA). All federal actions are subject to NEPA (Public Law 91-190, 42 U.S.C. 4321 et seq.). NEPA sets forth the requirement for all major federal actions to be evaluated in terms of their potential significant impact on the quality of the human and natural environment for the purpose of avoiding or, where possible, minimizing significant adverse impacts. NEPA established the Council on Environmental Quality (CEQ) to oversee the federal government's responsibilities. Federal activities affecting the physical and biological environment are regulated in part by CEQ through regulations in Title 40 CFR, Parts 1500-1508. Each agency, such as APHIS, develops its own guidelines to comply with NEPA requirements. In accordance with CEQ and USDA regulations, APHIS Guidelines Concerning Implementation of NEPA Procedures, as published in the Federal Register (44CFR 50381-50384) provide guidance to APHIS and WS regarding the NEPA process. TWSP follows the CEQ regulations implementing NEPA (40 CFR 1500 et seq.), USDA (7 CFR 1b), and the APHIS Implementing Guidelines (7 CFR 372) as a part of the decision-making process. These laws, regulations, and guidelines generally outline five broad types of activities that need to be accomplished as part of any project: scoping, analysis, documentation, implementation, and monitoring.

This EA for AMDM, with TWSP as the lead agency, is the first time that all land classes under *Cooperative Agreements* or *Agreements for Control* will be analyzed in the analysis area in a comprehensive manner. TWSP coordinates specific projects and programs with other agencies. The purpose of these contacts is to coordinate any WDM that may affect resources managed by these agencies or affect other areas of mutual concern. Federal agency requests for TWSP assistance to protect resources outside the species discussed in this EA would be reviewed, and if necessary, the agency requesting the assistance would be responsible for NEPA compliance.

1.8.2.2 Endangered Species Act (ESA). It is TWSP and Federal policy, under ESA, that all Federal agencies shall seek to conserve T&E species and shall utilize their authorities in furtherance of the purposes of the Act (Sec.2(c)). TWSP conducts consultations with the USFWS, as required by Section 7 of the ESA, to utilize the expertise of the USFWS, to ensure that "*any action authorized, funded or carried out by such an agency . . . is not likely to jeopardize the continued existence of any endangered species or threatened species. . .*" (Sec.7(a)(2)). WS has obtained a Biological Opinion from USFWS describing potential effects on T&E species and prescribing reasonable and prudent measures for avoiding jeopardy (USDA 1997, Appendix F). TWSP has also conducted informal consultations with USFWS for the proposed AMDM program specifically concerning the T&E species in Texas.

1.8.2.3 Migratory Bird Treaty Act of 1918 (16 U. S. C. 703-711; 40 Stat. 755), as amended. The Migratory Bird Treaty Act provides the USFWS regulatory authority to protect species of birds that migrate outside the United States. Migratory birds are not targeted in AMDM, but any migratory birds taken incidentally to AMDM as nontargets are regulated under the Act.

1.8.2.4 Clean Water Act (Section 404). Section 404 (33 U.S.C. 1344) of the Clean Water Act prohibits the discharge of dredged or fill material into waters of the United States without a permit from the Corps unless the specific activity is exempted in 33 CFR 323 or covered by a nationwide permit in 33 CFR 330.

The removal of most beaver dams are covered by these regulations (33 CFR 323 and 330). However, a recent court decision, the Tulloch Rule Decision, determined that minimal quantities of material released during excavation activities, such as may occur during beaver dam removal, may be considered allowable "incidental fallback", not be governed by Section 404 (Wayland and Shaeffer 1997).

1.8.2.5 Fish and Wildlife Coordination Act. The Fish and Wildlife Coordination Act encourages federal agencies to conserve and promote conservation of nongame fish and wildlife and their habitats to the maximum extent possible within each agency's statutory responsibilities.

1.8.2.6 Food Security Act. The Wetland Conservation provision (Swampbuster) of the 1985 (16 U.S.C. 3801-3862), 1990 (as amended by PL 101-624), and 1996 (as amended by PL 104-127) farm bills require all agricultural producers to protect wetlands on the farms they own in order to maintain USDA program benefits. They can convert wetlands at the risk of losing their ability to participate in all USDA farm assistance programs. Wetlands converted to croplands prior to December 23, 1985 are not subject to wetland compliance provisions as long it remains in agricultural use (land devoted to the production of food, fiber or horticultural crops) and is not abandoned (agricultural activity ceases). If conservation compliance lands, farmed wetlands or farmed wetland pastures are not used in agriculture for more than 5 consecutive years and wetland characteristics return, the cropland is considered abandoned and then becomes a wetland subject to regulations under Swampbuster and Section 404 of the Clean Water Act. The Natural Resources Conservation Service (NRCS) is responsible for certifying wetland determinations according to this Act.

1.8.2.7 Federal Insecticide, Fungicide, and Rodenticide Act. FIFRA requires the registration, classification, and regulation of all pesticides used in the United States. All pesticides used or recommended by the TWSP program are registered with and regulated by the EPA and TDA. TWSP uses the chemicals according to labeling procedures and requirements as regulated by the EPA and TDA. Currently, only zinc phosphide is registered for use to take muskrats and nutria in Texas under FIFRA.

1.8.2.8 National Historical Preservation Act of 1966 as amended (NHPA). The NHPA and its implementing regulation (CFR 36, 800) require federal agencies to: 1) determine whether proposed activities constitute "undertakings" that can result in changes in the character or use of historic properties and, 2) if so, to evaluate the effects of such undertakings on such historic resources and consult with the State Historic Preservation Office regarding the value and management of specific cultural, archaeological and historic resources; and 3) consult with appropriate American Indian tribes to determine whether they have concerns for traditional cultural properties in areas of these federal undertakings. Activities described under the proposed action do not cause major ground disturbance and are not undertakings as defined by the NHPA.

1.8.2.9 Native American Graves Protection and Repatriation Act. The Native American Graves Protection and Repatriation Act requires Federal agencies to notify the Secretary of the Department that manages the Federal lands upon the discovery of Native American cultural items on Federal or tribal lands. Federal projects would discontinue work until a reasonable effort has been made to protect the items and the proper authority has been notified.

1.8.2.10 Executive Orders 11988 and 11990 – Floodplain Management and Protection of Wetlands. These Executive Orders require that agencies avoid, to the extent possible, long and short term adverse impacts associated with the destruction or modification of floodplains and wetlands and minimize impacts to these areas. The purpose of these Executive Orders was to ensure protection and proper management of

flood plains and wetlands by Federal agencies. The Executive Orders require Federal agencies to consider the direct and indirect adverse effects of their activities on flood plains and wetlands. This requirement extends to any Federal action within a floodplain or a wetland except for routine maintenance of existing Federal facilities and structures. The Clinton administration had proposed revising Executive Order 11990 to direct Federal agencies to consider wetland protection and restoration planning in the larger scale watershed/ecosystem context.

1.8.2.11 Environmental Justice and Executive Order 12898 - Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. Environmental Justice has been defined as the pursuit of equal justice and equal protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status. Executive Order 12898 requires Federal agencies to make Environmental Justice part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of Federal programs, policies and activities on minority and low-income persons or populations. A critical goal of Executive Order 12898 is to improve the scientific basis for decision-making by conducting assessments that identify and prioritize environmental health risks and procedures for risk reduction. Environmental Justice is a priority both within USDA, APHIS and WS. APHIS plans to implement Executive Order 12898 principally through its compliance with the provisions of NEPA.

TWSP activities are evaluated for their impact on the human environment and compliance with Executive Order 12898 to ensure Environmental Justice. TWSP personnel use WDM methods as selectively and environmentally conscientiously as possible. All chemicals used by APHIS-WS are regulated by EPA and TDA through FIFRA, by MOUs with Federal land managing agencies, and by WS Directives. Based on a thorough Risk Assessment, APHIS concluded that when WS program chemicals are used following label directions, they are highly selective to target individuals or populations, and such use has negligible impacts on the environment (USDA 1997, Appendix P). The WS operational program properly disposes of any excess solid or hazardous waste. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minority and low-income persons or populations.

1.8.2.12 Executive Order 13045 - Protection of Children from Environmental Health and Safety Risks. Children may suffer disproportionately from environmental health and safety risks for many reasons, including their development, and physical and mental status. Because TWSP makes it a high priority to identify and assess environmental health and safety risks that may disproportionally affect children, TWSP has considered the impacts that this proposal might have on children. The proposed AMDM program would occur by using only legally available and approved methods where it is highly unlikely that children would be adversely affected. For these reasons, TWSP concludes that it would not create an environmental health or safety risk to children from implementing this proposed action.

1.8.2.13 Executive Order 13112 - Invasive Species. Nonnative plants and animals that inadvertently find their way to the U.S. are of increasing concern as they threaten our natural resources. One study estimates that the total costs of invasive species in the United States amount to more than $100 billion each year (Pimentel et. al. 2000). Invasive species impact nearly half of the T&E species listed under ESA. Nutria could be considered an invasive species and have damaged native ecosystems, including T&E species, in some parts of Texas.

1.8.3 Compliance with State Laws

Several Texas laws regulate TWSP and AMDM. TWSP complies with these laws, and consults and cooperates with State agencies as appropriate.

Title 10 Health and Safety Code Subchapters 825.001 - 825.007. These statues of the Health and Safety Code establish the cooperative arrangement between WS and Texas A&M University System and allows TWSP to operate as a cooperative program controlling predatory animals and rodents to protect livestock, food and feed supplies, crops, and ranges. The statutes also allows local governing bodies such as counties to enter into an agreement with TWSP. Section 825.007 specifically exempts personnel performing their duties under this subchapter from licensing requirements under Title 5 of the Parks and Wildlife Code.

Title 5 Parks and Wildlife Code Subchapter 71.004. his statute allows landowners or their agents to take nuisance fur-bearing animals in any number by any means at any time on that person's land to relieve damage-related situations without a hunting or trapping license.

Title 5 Parks and Wildlife Code Subchapter 68.001 - 68.021. Chapter 68 of the Parks and Wildlife Code established Texas' endangered species law equivalent to the ESA. The statute requires that federally listed T&E species be placed on the list. In addition, on the basis of investigations on wildlife, other available scientific and commercial data and after consultation with wildlife agencies in other states, appropriate federal agencies, local and tribal governments and other interested persons and organizations, the commission director shall by regulation develop a list of those species of wildlife indigenous to the state that are determined to be threatened or endangered within Texas.

Title 5 Parks and Wildlife Code Subchapter 65.378. This statute requires any person relocating a fur-bearing animal to have a permit from TPWD and a letter from the property owner where the animal(s) are to be released.

Title 5 Parks and Wildlife Code Subchapter 43.151-57. These statutes provide the permitting process to control protected wildlife, including T&E species, that are causing damage or public health concerns.

1.9 A PREVIEW OF THE REMAINING CHAPTERS IN THIS EA

This EA is composed of 5 chapters. Chapter 2 discusses and analyzes the issues and affected environment. Chapter 3 contains a description of each alternative, alternatives not considered in detail, and mitigation and SOPs. Chapter 4 analyzes the environmental impacts associated with each alternative considered in detail. Chapter 5 contains the list of preparers of this EA, persons consulted, and literature cited in the EA.

CHAPTER 2: ISSUES

Chapter 2 contains a discussion of the issues, including those that will receive detailed environmental impacts analysis in Chapter 4 (Environmental Consequences), and those that were used to develop mitigation measures and SOPs. In addition, some issues arose that, with rationale, were not considered in detail. Pertinent portions of the affected environment will be included in this chapter in the discussion of issues used to develop mitigation measures. Additional information on affected environments will be incorporated into the discussion of the environmental impacts in Chapter 4.

Issues are concerns of the public or professional communities about potential environmental problems that might occur from a proposed federal action. Such issues must be considered in the NEPA decision process. Issues relating to the management of wildlife damage were raised during the scoping process in preparing the WS programmatic nationwide EIS (USDA 1997) and were considered in the preparation of this EA. These issues are fully evaluated within USDA (1997), which analyzed data specific to TWSP.

2.1 ISSUES CONSIDERED

Following are issues that have been identified as areas of concern requiring consideration in this EA.

- Effects on Target Aquatic Mammal Species Populations
- Effects on Nontarget Species Populations, Including T&E Species
- Humaneness of Control Techniques
- Effects of Beaver Dam Removal on Wetland Wildlife Habitat
- Effects of AMDM Methods on Public Safety

Potential environmental impacts of the Proposed Action and Alternatives in relation to these issues are discussed in Chapter 4. All issues except the final two have also been addressed in detail in USDA (1997). As part of this process, and as required by CEQ and APHIS, NEPA implementing regulations, this EA is being made available to the public through "Notices of Availability" published in local media and through direct mailings of the Notice to parties that have specifically requested to be notified. New issues or alternatives raised after publication of public notices will be fully considered to determine whether the EA is adequate to make a Decision or, if appropriate, be revised with a new analysis for new issues or alternatives. After that time, a Record of Decision will be made available to the public with the Alternative selected or a notice to prepare an EIS.

2.2 ISSUES USED TO DEVELOP MITIGATION

2.2.1 Effects on Nontarget Species Populations, Including T&E Species

A common concern among members of the public and wildlife professionals, including TWSP personnel, is the impact of AMDM control methods and activities on nontarget species, particularly T&E species. TWSP SOPs include measures intended to mitigate or reduce the effects of AMDM on nontarget species populations and are presented in Chapter 3.

Special efforts are made to avoid jeopardizing T&E species through biological evaluations of potential effects and the establishment of special restrictions or mitigation measures. A description of mitigation measures established to avoid jeopardizing T&E species are presented in Chapter 3, the results of a biological analysis given in Chapter 4.

2.2.2 Humaneness of Methods Used by TWSP

The issue of humaneness and animal welfare as it relates to killing or capturing wildlife is an important and very complex concept that can be interpreted in a variety of ways. Schmidt (1989) indicated that vertebrate pest damage management for societal benefits could be compatible with animal welfare concerns if "*. . . the reduction of pain, suffering, and unnecessary death is incorporated in the decision making process.*" Suffering is described as a "*. . . highly unpleasant emotional response usually associated with pain and distress.*" However, suffering "*. . . can occur without pain . . .*" and "*. . . pain can occur without suffering . . .*" (American Veterinary Medical Association (AVMA) 1987). Because suffering carries with it the implication of a time frame, a case could be made for "*. . . little or no suffering where death comes immediately . . .*" (California Department of Fish and Game (CDFG) 1991), such as shooting.

Defining pain as a component of humaneness in WS methods appears to be a greater challenge than that of suffering. Pain obviously occurs in animals. Altered physiology and behavior can be indicators of pain, and identifying the causes that elicit pain responses in humans would "*. . . probably be causes for pain in other animals . . .*" (AVMA 1987). However, pain experienced by individual animals probably ranges from little or no pain to significant pain (CDFG 1991). Pain and suffering, as it relates to damage management methods, has both a professional and lay point of arbitration. Wildlife managers and the public would be better served to recognize the complexity of defining suffering since "*. . . neither medical nor veterinary curricula explicitly address suffering or its relief*" (CDFG 1991). Research suggests that some methods, such as restraint in leg-hold traps or changes in the blood chemistry of trapped animals, indicate "*stress*" (USDA 1997). However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness. The AVMA states "*... euthanasia is the act of inducing humane death in an animal*" and "*... the technique should minimize any stress and anxiety experienced by the animal prior to unconsciousness.*" (Beaver et al. 2001).

Some people would prefer that only AVMA accepted methods of euthanasia be used when killing all animals, including wild and feral animals. The AVMA states that "*For wild and feral animals, many of the recommended means of euthanasia for captive animals are not feasible. In field circumstances, wildlife biologists generally do not use the term euthanasia, but use terms such as killing, collecting or harvesting, recognizing that a distress-free death may not be possible.*" (Beaver et al. 2001). The decision-making process involves tradeoffs between the above aspects of pain and humaneness. An objective analysis of this issue must consider not only the welfare of wild animals, but also the welfare of humans if damage management methods were not used. Therefore, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal. People may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of animal suffering within the constraints imposed by current technology and funding.

WS has improved the selectivity and humaneness of management techniques through research and development. Research is continuing to bring new findings and products into practical use. Until new findings and improved products are proven practical and reliable, a certain amount of animal suffering could

occur when some wildlife damage management methods are used. In certain situations non-lethal damage management methods are not practical or effective. TWSP personnel are experienced and professional in their use of management methods to increase humaneness as much as possible under the constraints of current technology, workforce and funding. Some TWSP damage management methods such as leghold traps, body snares, and even repellents may thus cause varying degrees of pain in different animal species for varying time frames. At what point pain diminishes or stops under these types of restraint devices has not been measured by the scientific community. Mitigation measures and SOPs used to maximize humaneness are listed in Chapter 3.

Some people are concerned about the humaneness of drowning aquatic mammals while restrained by leg-hold traps and snares. Considerable debate and disagreement among animal activists, veterinarians, wildlife professionals, fur trappers and nuisance wildlife specialists is apparent. Debate centers around an uncertainty as to whether drowning animals are rendered unconscious by high levels of carbon dioxide (CO_2) and thus insensitive to distress and pain (Ludders et al. 1999). The AVMA identifies drowning as an unacceptable method of euthanasia (Beaver et al. 2001), but provides no literature citations to support this position. Ludders et al. (1999) concluded drowning is not euthanasia based on the animals not dying from CO_2 narcosis, because CO_2 narcosis does not occur until 95 millimeters of mercury in arterial blood is exceeded. Ludders et al. (1999) showed death during drowning is from hypoxia and anoxia, and thus animals experience hypoxemia. Ludders et al. (1999) also concluded that animals that drown are distressed because of stress related hormones, epinephrine and norepinephrine; therefore, drowning is not euthanasia.

CO_2 causes death in animals by hypoxemia and some animals (i.e. cats, rabbits, and swine) are distressed before death (Beaver et al. 2001). Even though these animals are distressed, the AVMA states this death is an acceptable form of euthanasia (Beaver et al. 2001). Thus, the AVMA does not preclude distress or pain in euthanasia. In fact, the AVMA supports inducing hypoxemia related distress when necessary to reduce total distress, because reducing total distress is a more humane death.

Death by drowning in the classical sense is caused by inhalation of fluid into the lungs and is referred to as wet drowning (Gilbert and Gofton 1982, Noonan 1998). Gilbert and Gofton (1982) reported that all submerged beaver do not die from wet drowning, but die of CO_2 induced narcosis. According to Gilbert and Gofton (1982) and Noonan (1998), the AVMA accepts CO_2 as a suitable form of euthanasia. Gilbert and Gofton (1982) also reported that after beaver were trapped and entered the water struggling occurred for 2-5 minutes followed by a period of reflexive responses. Andrews et al. (1993) reports that with some techniques that induce hypoxia, some animals have reflex motor activity followed by unconsciousness that is not perceived by the animal. Gilbert and Gofton (1982) stated it is unknown how much conscious control actually existed at this stage and anoxia may have removed much of the sensory perception by 5-7 minutes post submersion. However, Gilbert and Gofton (1982) have been criticized because levels of CO_2 in the blood were not reported (Ludders et al. 1999) and there was insufficient evidence that the beaver in their study were under a state of CO_2 narcosis when they died (V. Nettles, Southeastern Cooperative Wildlife Disease Study, letter to W. MacCallum, Massachusetts Division of Fisheries and Wildlife, June 15, 1998). Adding to the controversy, Clausen and Ersland (1970) did measure CO_2 in the blood for submersed restrained beaver, yet none of the beaver in the study died. Therefore, Clausen and Ersland (1970) could not determine if beavers die of CO_2 narcosis. However, Clausen and Ersland (1970) were able to demonstrate that CO_2 increased in arterial blood while beaver were submersed and that CO_2 was retained in tissues. While Clausen and Ersland (1970) did measure the amounts of CO_2 in the blood of submersed beaver they did not attempt to measure the analgesic effect of CO_2 buildup to the beaver (V. Nettles, Southeastern

Cooperative Wildlife Disease Study, letter to W. MacCallum, Massachusetts Division of Fisheries and Wildlife, June 15, 1998).

When beaver are captured using leg-hold traps or snares with intent to drown, beaver are exhibiting a flight response. Gracely and Sternberg (1999) reported that there is stress-induced analgesia resulting in reduced pain sensitivity during fight and flight responses. Environmental stressors that animals experience during flight or fight activate the same stress-induced analgesia (Gracely and Sternberg 1999).

Use of drowning trap sets has been a traditional wildlife management technique in trapping aquatic mammals. Trapper education manuals and other wildlife damage management manuals written by wildlife biologists recommend drowning sets for leghold traps set for beaver (Howard et al.1980, Randolph 1988, Bromley et al. 1994, Dolbeer et al. 1994, Miller and Yarrow 1994). In some situations drowning trap sets are the most appropriate and efficient method available to capture aquatic mammals. For example, a drowning set attachment should be used with leg-hold traps when capturing beaver to prevent the animal from injury while restrained or from escaping (Miller and Yarrow 1994). Animals that drown die relatively quickly (e.g., within minutes) versus the possible stress of being restrained and harassed by people, dogs and other wildlife before being euthanized. Drowning sets make the captured animal and trap less visible and prevent injury (i.e., bites and scratches) to people who may otherwise approach a restrained animal. Furthermore, some people are offended seeing dead animals and drowning often takes the dead animal out of public view. Some sites may be unsuitable for body-gripping traps or snares because of unstable banks, deep water or substrate conditions. However, these sites would be suitable for leghold traps. In some situations where muskrats occur in high densities, multiple catch colony traps may be the most efficient method to reduce populations and alleviate damage. Therefore, drowning is a humane way of killing muskrats (Gilbert and Gofton 1982) in colony traps.

Given the short time period of a drowning event, possible analgesic effect of CO_2 buildup to beaver, the minimum, if any, pain or distress on drowning animals, the AVMA's acceptance of hypoxemia as euthanasia and a minimum of pain and distress during euthanasia, acceptance of catching and drowning aquatic rodents approved by International Humane Trapping Standards, the conclusion has been drawn that drowning is acceptable. Some people will disagree and remain unswayed.

2.2.3 Effects of Beaver Dam Removal on Wetland Wildlife Habitat

Some people are concerned about the effects of the alternatives on the wetland ecosystem and that the removal of beaver dams or breaching beaver dams from an area will result in the loss of wetland habitat and the plant and animal species included in those wetlands. Beavers build dams primarily in smaller riverine wetlands (intermittent and perennial streams and creeks) with dams consisting of mud, stick, and other vegetative materials. Their dams obstruct the normal flow of water and typically change the preexisting wetlands' hydrology from flowing or circulating waters to slower, deeper, more expansive waters that accumulate bottom sediment; the depth of the bottom sediment depends on the length of time an area is covered by water and the amount of suspended sediment in the water.

TWSP beaver damage management activities are primarily conducted to alleviate damages to agricultural crops, timber resources, and public property such as: roads, irrigations structures, bridges and water management facilities. Activities are also conducted to enhance or reclaim wildlife and stream fishery habitats. TWSP operations routinely incorporate population reduction with dam breaching, removal, or

installation of temporary water levelers or exclusion devices. Dams are breached by hand, where possible, or with small charges of binary explosives. No heavy equipment such as backhoes or bulldozers are used by TWSP in these damage reduction and wildlife enhancement activities, but can be by private individuals. These activities take place on small watershed streams, tributary drainages, and ditches and can best be described as small projects conducted to restore water flow through previously existing channels. Only that portion of the dam blocking the stream or ditch channel is altered or breached. Projects involving the use of binary explosives are all conducted by trained TWSP Specialists who are certified explosive specialists. After a blast, any remaining fill material still obstructing the channel is normally washed downstream by water current. The only noticeable side effects from this activity are diluted mud, water, and small amounts of debris from the dam scattered around the blasting site. Considerably less than 10 cubic yards of material is moved in each of these project activities.

Newly established beaver ponds are not considered wetlands (Texas Agricultural Extension Service 1998). However, over time, beaver dams can establish new, but different wetlands. The Corps and the U. S. Environmental Protection Agency's (EPA) regulatory definition of a wetland (40 CFR 232.2) is:

> *Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.*

Therefore, per this definition, a site needs to meet three qualifications to be considered a wetland. First, it must contain soils saturated by surface or ground water during a specific period of the growing season. Hydric soils are those soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part. In general, hydric soils form much easier where wetlands preexisted. Secondly, the site must exhibit evidence of wetland hydrology. An area has wetland hydrology if it is inundated or saturated to the surface for at least 5% of the growing season in most years. Finally, the site must be dominated by hydrophytic vegetation which are those species tolerant of and specially adapted to live in saturated soil conditions. Hydrophytic vegetation includes those plants that grow in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content. These three factors must be present for an area to be classified as a wetland (Texas Agricultural Extension Service 1998). If a beaver dam is not breached and water is allowed to stand, hydric soils and hydrophytic vegetation eventually form. This process, though, can take years depending on preexisting conditions.

The preexisting habitat and the altered habitat have different ecological values to the fish and wildlife native to the area. Some species will abound by the addition of a beaver dam (Avery 1992), while others will diminish (Patterson 1951, Churchill 1980). Beaver dams, when they become an established wetland, can potentially be beneficial to some species of wildlife such as river otters and some species of waterfowl. But the dams may also be detrimental. For example, some species of darters (*Etheostoma spp.*) listed as T&E species require fast moving waters over gravel or cobble beds which beaver dams can eliminate, thus reducing the habitat's value for these species.

The intent of dam breaching is not to drain old established wetlands. With few exceptions, TWSP receives requests from public agencies, private individuals, and entities to alleviate water damage, or threat of damage, to resources resulting from newly constructed dams. Often, breaching occurs within months of dam construction, thus returning an area back to its preexisting condition. The Texas Agricultural Extension

Service (1998) discusses the removal of dams and suggests that a beaver dam be removed before it is 2 years old, insuring removal before the area exhibits defining soil and vegetative characteristics of a wetland. Hydric soils, an important criteria, often takes more than 5 years to develop and serves as a key wetland identifier, as recognized by Swampbuster provisions. Beaver dam removal by TWSP is allowed under exemptions as stated in 33 CFR parts 323 and 330 of Section 404 of the Clean Water Act or parts 3821 and 3822 of the Food Security Act. However, the removal of some beaver dams can trigger certain portions of Section 404 that require landowners to obtain permits from the Corps. TWSP personnel determine the proper course of action in talking with the landowner and upon inspecting a beaver dam impoundment.

2.2.4 Effects of AMDM Methods on Public Safety

A formal risk assessment of WS methods, including almost all of those used for AMDM in Texas, concluded low risks to humans (USDA 1997, Appendix P). One specific method was not fully addressed in detail in the assessment, the use of explosives to remove beaver dams.

2.3 ISSUES NOT CONSIDERED IN DETAIL WITH RATIONALE

2.3.1 TWSP's Impact on Biodiversity

No TWSP activity is conducted to eradicate any wildlife population. TWSP operates in accordance with international, federal, and state laws and regulations enacted to ensure species viability. Any reduction of a local population would be temporary because immigration from adjacent areas or reproduction by remaining animals would soon replace those removed. TWSP's impacts on biodiversity are not significant nationwide or in Texas (USDA 1997). TWSP operates on a relatively small percentage of land area in Texas and TWSP take is a small proportion of the total species population as analyzed in Chapter 4.

2.3.2 Wildlife Damage Should Be an Accepted Loss -- a Threshold of Loss Should Be Reached Before Providing AMDM Services

TWSP is aware of concerns that federal WDM should not be allowed until economic losses become unacceptable. Although some loss of resources to wildlife can be expected and tolerated, TWSP has the legal direction to respond to requests for WDM, and it is Program policy to aid each requester to minimize losses. TWSP uses the Decision Model discussed in Chapter 3 to determine an appropriate strategy.

In a ruling for Southern Utah Wilderness Alliance, et al. vs. Hugh Thompson, Forest Supervisor for the Dixie NF, et al., the United States District Court of Utah upheld the determination that a WDM program may be established based on threatened damage. In part, the court found that a forest supervisor need only show that damage (from predators) is threatened to establish a need for WDM (Civil No. 92-C-0052A January 20, 1993). Thus, there is precedent for conducting AMDM when damage has not yet occurred but is only threatened.

2.3.3 WDM Should Be Fee Based and Not a Taxpayer Expense

TWSP is aware of concerns that WDM should not be provided at taxpayer's expense and that it should be fee based. WS was established by Congress and Extension-WS by the State Legislature as the agencies

responsible for providing WDM to the people of the United States and Texas. Funding for TWSP AMDM comes from a variety of sources in addition to federal appropriations. Most field personnel conducting AMDM are funded with State appropriations. Other nonfederal sources include local government funds (county or city), producer associations, and individual private citizens which are all applied toward program operations. Federal, state, and local officials have decided that WDM needs to be conducted and have allocated funds for these activities. Additionally, WDM is an appropriate sphere of activity for government programs, since wildlife management is a government responsibility. A commonly voiced argument for publicly funded WDM is that the public should bear responsibility for damage to private property caused by "publicly-owned" wildlife.

2.3.4 Public Concern about the Use of Chemicals

Much of the public concern over the use of chemicals and toxicants for WDM is based on an erroneous perception that WS uses non-selective, outdated chemical methodologies. However, chemical methods used and proposed for use by WS have a high degree of selectivity. Currently, use of toxicants by WS in all instances is regulated by EPA and TDA under FIFRA, MOUs with other agencies, and by WS Directives. Based on a thorough Risk Assessment, APHIS concluded that, when WS program chemicals are used according to label directions, they are selective for target individuals or populations, and such use has negligible impacts on the environment (USDA 1997). A decision to ban toxicants is outside of WS authority. WS could elect not to use toxicants, but zinc phosphide, the only registered toxicant for use in Texas, is an integral part of IWDM and its selection for use would follow criteria in the Decision Model (Slate et al. 1992).

2.3.5 Appropriateness of the Geographic Scope of the EA, Statewide

Federal agencies have the discretion to determine the geographic scope of their NEPA analyses (*Kleppe v. Sierra Club,* 427 U.S. 390, 414 (1976)) and WS has determined that preparation of this EA to address AMDM activities for Texas in its entirety is appropriate. In terms of considering cumulative impacts, one EA covering Texas is likely to provide a better analysis of impacts than multiple EA's covering smaller zones within the analysis area. For example, TPWD monitors the furbearer populations at the statewide level and in smaller units, and TWSP information compares best at the state level. In addition, a more detailed site-specific level of analysis would not substantially improve the decision-making process. Pursuing a more detailed, site-specific analysis might even be considered inconsistent with NEPA's emphasis on reducing unnecessary paperwork (Eccleston 1995). If, as a result of this EA, a determination is made that the proposed action would have a significant environmental impact, an EIS would be prepared.

2.3.6 Concerns That the Proposed Action May Be "Highly Controversial" and Its Effects May Be "Highly Uncertain," Both of Which Would Require That an EIS Be Prepared

The failure of any particular special interest group to agree with every Federal agency action does not create a controversy, and NEPA does not require the courts to resolve disagreements among various scientists as to the methodology used by an agency to carry out its mission (Marsh v. Oregon Natural Resource Council, 490 U.S. 360, 378 (1989)). Although opposition exists to AMDM, this action is not highly controversial in terms of size, nature, or effect. If, as a result of this EA, a determination is made that the proposed action would have a significant environmental impact, an EIS would be prepared.

2.3.7 Impacts of Limiting Aquatic Mammal Numbers on the Public's Aesthetic Enjoyment

Wildlife is generally regarded as providing economic, recreational, and aesthetic benefits (Decker and Goff 1987). The mere knowledge that wildlife exists is a positive benefit to many people. Some members of the public have expressed concerns that AMDM could result in the loss of aesthetic benefits from seeing aquatic mammals. Aesthetics, a philosophy, deals with the nature of beauty or appreciation of beauty. Therefore, aesthetics is truly subjective, dependent on what an observer regards as beautiful. Controlling damaging aquatic mammals, in actuality, provides more aesthetic surroundings. Therefore, it has been determined that aesthetics could be positively or negatively affected, but this would only be at a very local level. Property owners requesting AMDM will view the action as aesthetic. People that believe the loss of production of aquatic mammals in the area is unaesthetic will view the action as negative. However, they will still have an opportunity to see aquatic mammals elsewhere in the State because TWSP only conducts AMDM on a small percentage of Texas lands.

CHAPTER 3: ALTERNATIVES INCLUDING THE PROPOSED ACTION

3.1 ALTERNATIVES ANALYZED IN DETAIL

3.1.1 Alternative 1 - Continue the Current TWSP AMDM Activities (the Proposed Action/No Action Alternative)

This is the Proposed Action as described in Chapter 1 and is the "No Action" alternative as defined by CEQ for ongoing Programs. TWSP would continue its current AMDM program.

3.1.2 Alternative 2 - Technical Assistance Only

Under this alternative, TWSP would not conduct any direct operational AMDM activities in Texas. If requested, affected resource owners would be provided technical assistance information only. It is possible that some affected resource owners could be left to their own accord to stop damage created by aquatic mammals.

3.1.3 Alternative 3 - Nonlethal AMDM Only

This alternative would not allow lethal control or recommendations by TWSP. TWSP would be allowed to use nonlethal control measures including all methods used in AMDM except quick-kill traps, shooting, zinc phosphide, and euthanasia drugs; animal would have to be relocated to use methods that live capture aquatic mammals such as leghold traps, cage traps, and snares.

3.2 DESCRIPTION OF THE ALTERNATIVES

3.2.1 Alternative 1 - Continue the Current TWSP AMDM Activities

A succinct description of the proposed action was presented in Chapter 1. The discussion that follows contains further information intended to foster understanding of TWSP's rationale for constructing the proposed action.

3.2.1.1 IWDM. For more than 70 years, WS has considered, developed, and used numerous methods of managing wildlife damage problems (USDA 1997, P. 2-15). The efforts have involved research and development of new methods and the implementation of effective strategies to resolve wildlife damage. The most effective approach to resolving wildlife damage is to integrate the use of several methods simultaneously or sequentially. IWDM is the implementation and application of safe and practical methods for the prevention and control of damage caused by wildlife based on an analysis of the local problem and the informed judgement of trained personnel. The TWSP Program applies IWDM (WS Directive 2.105), to reduce damage through the WS Decision Model (Slate et. al. 1992) described in USDA (1997).

The philosophy behind IWDM is to implement effective management techniques in a cost effective manner while minimizing the potentially harmful effects on humans, target species, nontargets, and the environment. IWDM draws from the largest possible array of options to create a combination of techniques appropriate for the specific circumstances. IWDM may incorporate cultural practices (i.e. animal husbandry), habitat modification, physical exclusion, animal behavior (i.e. scaring), local population reduction, or any combination of these, depending on the characteristics of the specific damage problems.

In selecting management techniques for specific damage situations consideration is given to the:

- Species responsible;
- Magnitude and geographic extent of damage;
- Duration and frequency of the damage;
- Prevention of future damage (lethal and nonlethal techniques); and
- Environmental concerns such as T&E species in the same area.

The cost of IWDM may be secondary because of overriding environmental, legal, human health and safety, animal welfare, or other concerns.

3.2.1.2 IWDM Strategies That TWSP Employs. TWSP employs different strategies to resolve wildlife damage problems. In certain situations, TWSP may provide cooperators with the information necessary to resolve the problem themselves (technical assistance). In others, TWSP may directly resolve the problem (direct assistance). However, the most common strategy to resolve wildlife damage is to use a combination of these approaches as outlined in IWDM.

Technical Assistance Recommendations. When assistance is requested, TWSP may elect to only provide advice on how to resolve the problem, leaving the requestor responsible for implementation. TWSP personnel provide information, demonstrations, and advice on many of the available IWDM techniques. Technical assistance includes demonstrations on the proper use of management devices (pond-levelers, cage traps, etc.) and information and advice on habitat management and animal behavior modification devices. Technical assistance is generally provided following an on-site visit or verbal consultation with the requestor. Generally, several management strategies are described to the requestor for short and long-term solutions and are based on the level of risk, the abilities of the requestor, need, and practical application. Technical assistance may require substantial effort by TWSP personnel in the decision making process, but actual management is primarily the requestor's responsibility.

Direct Control Assistance. Some AMDM activities are directly conducted or supervised by TWSP personnel. Direct control assistance is implemented when the problem cannot effectively be resolved through technical assistance alone or when *Cooperative Agreements* provide for TWSP direct control assistance. The initial investigation defines the nature and history of the problem, extent of damage, and the species responsible for the damage. Professional skills of TWSP personnel are often required to effectively resolve problems, while some problems may require the direct supervision of a wildlife professional. TWSP considers the biology and behavior of the damaging species and other factors using the WS Decision Model (Slate et al. 1992). The recommended damage management program to resolve a problem may include any combination of preventive and corrective actions that could be implemented by the requestor, TWSP, or other agency, as appropriate.

Preventive Damage Management. Preventive damage management is applying AMDM strategies before damage occurs, and is based on historical damage problems. As requested and appropriate, TWSP personnel provide information, conduct demonstrations, or take action to prevent these historical problems from recurring. For example, in areas where substantial damage by flooding has occurred historically and beaver have been removed, TWSP may provide information about effective exclusion, pond levelers, or other nonlethal techniques, or be requested to conduct operational AMDM after new activity is noticed prior to new damage.

Corrective Damage Management. Corrective damage management is applying AMDM to stop or reduce current losses. As requested and appropriate, TWSP personnel provide information and conduct demonstrations or, with the appropriate signed agreement, take action to prevent additional losses from recurring. For example, in areas where roads have been flooded, TWSP may provide information about exclusion methods or pond levelers, and conduct operational AMDM to stop the losses. Corrective damage management is usually the most common AMDM strategy.

3.2.1.3 AMDM Methods. This section summarizes the best technology for resolving aquatic mammal damage that has evolved from continued development and refinement by research and the experience of professional wildlife biologists. Several AMDM methods are available for use. Resource owner practices consist primarily of nonlethal preventive methods such as exclusion and habitat modifications. Resource owners are encouraged to use these methods, based on the level of risk, need, and professional judgement of their effectiveness and practicality (Slate et al. 1992). TWSP employs several lethal control methods to selectively remove aquatic mammals causing damage where nonlethal techniques would not adequately address the damage situation.

Most AMDM methods have strengths and weaknesses in each specific damage situation, and can range from being very effective at reducing damage to being virtually of no value. TWSP personnel using the WS Decision Model (Slate et al. 1992) can determine, for each AMDM situation, the method or combination of methods that is most appropriate and effective. The following is basic list of AMDM methods given consideration by TWSP, a discussion of their use, and specific species targeted by their use. Methods fall into 3 basic categories: resource management, physical exclusion, and wildlife management.

Resource Management

Modification of human behavior is often used by TWSP personnel to resolve potential conflicts between humans and wildlife by altering the perception of an action. For example, WS may talk with area residents to eliminate feeding wildlife occurring in parks, recreational sites, or residential areas. This both reduces wildlife damage and the likelihood that certain species, such as nutria, will become approach people, yet remain very aggressive. Many wildlife species adapt well to human settlements and activities, but their proximity to humans may result in damage to structures or threats to public health and safety. Eliminating wildlife feeding and handling can reduce potential problems, but many people, not directly affected by wildlife problems, enjoy wild animals and engage in activities that encourage their presence. It is difficult to consistently enforce no-feeding regulations and effectively educate all people concerning the potential liabilities of feeding wildlife.

Habitat management, such as the removal of vegetation near water and/or damage-prone areas, aids in reducing cover, eliminating food sources, and possibly discouraging the presence of aquatic mammals. In addition to this, most habitat management is aimed at reducing the presence of aquatic mammals.

Beaver dam removal is done when beaver create a dam where the resource owner does not want the area to be flooded. Beaver damming activities can have varying affects on the environment. Their dams can create valuable wetland habitat for wildlife, especially where a dam holds water during drought periods. Conversely, dams can create sinks where water evaporates or percolates into the ground decreasing water flows needed for agricultural activities, some fish and wildlife species, and other resources. Breaching of beaver dams is generally conducted to maintain existing stream channels and drainage patterns, and reduce flood waters that have affected established silviculture, agriculture (i.e., ranching and farming activities),

roads, bridges, and residential and commercial property, or drainage structures such as culverts. Beaver dams are made from natural debris such as logs, sticks, and mud that beaver take from the immediate area. It is this portion that is dislodged during a beaver dam breaching operation. Breached impoundments are usually from recent beaver activity and the area has not been flooded or inundated with water long enough for the area to take on the qualities of a true wetland (i.e., hydric soils, hydrophytic vegetation, preexisting function).

Unwanted beaver dams can be breached using a rake, power tools (e.g., a winch) or machinery (e.g., backhoe), or with binary explosives (discussed below). Breaching does not affect the substrate or the natural course of the stream and returns the area back to its preexisting condition with similar flows and circulations. Because beaver dams involve waters of the United States, removal is regulated under Section 404 of the Clean Water Act. TWSP projects involving beaver dam breaching are discussed with the U.S. Army Corps of Engineers or are specifically exempted under Section 404.

Beaver dam breaching can have varying effects, both positive and negative on T&E species, depending on the species present. The breaching of recently built beaver dams from irrigation ditches and other artificial waterways (such as culverts where roads, bridges, buildings, or houses are constructed) will not have an effect on T&E species. However, the breaching of beaver dams created along creeks, streams, or other natural drainage areas could have varying affects on T&E species, depending on the species present.

Binary explosives are an efficient, cost-effective means to reduce flooding and property damage caused by beaver. TWSP uses a binary (i.e., 2-part) explosive composed of ammonium nitrate and nitro-methane. Mixed together, these chemicals become a high explosive (as defined by US Alcohol, Tobacco, Firearms, and Explosives). Depending on the surrounding area at a particular site, TWSP explosives specialists may use one of three different initiation systems: 1) fuse, 2) electric, or 3) non-electric. All explosives materials are consumed during the explosion; therefore, residual chemicals and other materials are nonexistent. However, some fumes and toxic gases are created during the explosion. Because dam breaching by use of explosives is normally conducted in an open area, vapors dissipate quickly. Fumes and vapors created by TWSP explosives use do not appear to effect the wildlife inhabiting the project area.

TWSP personnel must receive explosives training and be certified by WS before using explosives on any official projects (WS Directive 2.435). All TWSP explosive specialists are required to attend 24 hours of extensive explosive safety training and spend time with a certified explosive specialist in the field prior to obtaining certification. All blasting activities are conducted by well-trained, certified blasters and are closely supervised by professional wildlife biologists. WS Explosives Safety Manual on explosives handling and use follow the rules and guidelines set forth by the explosives industry in the United States and Canada. Additionally, a minimum of 8 hours of approved explosives refresher training are required every 2 years to maintain WS certification. All TWSP use, storage, and transportation of explosives are conducted in strict compliance with applicable Federal, State, and local laws and regulations and with the procedures outlined in the WS Explosives Safety Manual and in Occupational Safety and Health Administration Standard 1910.109, Explosives and Blasting Agents.

When a dam is removed, debris is discharged into the water. The debris that ends up in the water is considered "incidental fallback" or discharge fill. The Tulloch Rule Decision (Court Case No. 93cv01754) determined that "incidental fallback" did not trigger Section 404 permit requirements. It was not determined if beaver dams fit this category, but EPA and the Corps issued guidance to their regulatory offices that beaver dam removal may not require permits under Section 404 (Wayland and Shaeffer 1997). These agencies stated that they would give their field offices further guidance at a later date. However, in most beaver dam

removal operations, the material that is displaced, if considered to be discharge, is exempt from permit requirements under 33 CFR 323 or 330. A permit would be required if the impoundment caused by a beaver dam was considered a true wetland. TWSP personnel survey the beaver dam site and impoundment to determine whether conditions exist suggesting that the area may be a wetland as defined above. If such conditions exist, the landowner is asked the age of the dam or how long he/she has known of its presence to determine whether Swampbuster, Section 404 permit exemptions, or the Nationwide Permit (NWP) program allows removal of the dam. If not, the landowner is required to obtain a section 404 permit from the Corps before the dam will be removed by TWSP personnel.

The following information explains Section 404 exemptions and conditions that pertain to the removal of beaver dams.

33 CFR 323 - Permits For Discharges of Dredged or Fill Material into Waters of the United States. This regulation provides guidance to determine whether certain activities require permits under Section 404.

> **Part 323.4 Discharges not requiring permits.** This section establishes exemptions for discharging certain types of fill into waters of the United States without a permit. Certain minor drainage activities connected with normal farming, ranching, and silviculture activities where they have been established do not require a permit as long as these drainages do not include the immediate or gradual conversion of a wetland (i.e. beaver ponds greater than 5 years old) to a non-wetland. Specifically part (a)(1)(iii)(C)(i) states, "*...fill material incidental to connecting upland drainage facilities* [e.g., drainage ditches] *to waters of the United States, adequate to effect the removal of excess soil moisture from upland croplands...*". This indicates that beaver dams that block ditches, canals, or other structures designed to drain water from upland crop fields can be removed without a permit.
>
> Moreover, (a)(1)(iii)(C)(iv) states the following types of activities do not require a permit "*The discharges of dredged or fill materials incidental to the emergency removal of sandbars, gravel bars, or other similar blockages which are formed during flood flows or other events, where such blockages close or constrict previously existing drainageways and, if not promptly removed, would result in damage to or loss of existing crops or would impair or prevent the plowing, seeding, harvesting or cultivating of crops on land in established use for crop production. Such removal does not include enlarging or extending the dimensions of, or changing the bottom elevations of, the affected drainageway as it existed prior to the formation of the blockage. Removal must be accomplished within one year of discovery of such blockages in order to be eligible for exemption.*"; this allows the removal of beaver dams in natural streams to restore drainage of agricultural lands within one year of discovery.
>
> Part 323.4 (a) (2) allows "*Maintenance, including emergency reconstruction of recently damaged parts, of currently serviceable structures such as dikes, dams, levees, groins, riprap, breakwaters, causeways, bridge abutments or approaches, and transportation structures. Maintenance does not include any modification that changes the character, scope, or size of the original fill design. Emergency reconstruction must occur within a reasonable period of time after damage occurs in order to qualify for this exemption.*"; this allows beaver dams to be removed without a permit where they have resulted in damage to roads, culverts, bridges, levees, and irrigation structures and associated structures such as the irrigation ditch head gate, if it is done in a reasonable amount of time.

33 CFR 330 - Nationwide Permit (NWP) Program. The Corps Chief of Engineers is authorized to grant certain dredge and fill activities on a nationwide basis if they have minimal impact on the environment. The NWPs are listed in Appendix A of 33 CFR 330 and permittees must satisfy all terms and conditions established in order to qualify for their use. Individual beaver dam removal activities by TWSP may be covered by any of the following NWPs if not already exempted from permit requirements by the regulations discussed above. TWSP complies with all conditions and restrictions placed on NWPs for any instance of beaver dam removal done under a specific NWP.

There are numerous exceptions to the use of NWPs. If utilized, TWSP will document compliance with those exceptions.

NWP 3 authorizes the rehabilitation of those structures, such as culverts, homes, and bridges, destroyed by floods and "discrete events" such as beaver dams provided that the activity is commenced within 2 years of the date when the beaver dam was established.

NWP 18 allows minor discharges of dredged and fill material, including the removal of beaver dams, into all waters of the United States provided that the quantity of discharge and the volume of excavated area does not exceed 10 cubic yards below the plane of the ordinary high water mark (this is normally well below the level of the beaver dam) or is in a "special aquatic site" (wetlands, mudflats, vegetated shallows, riffle and pool complexes, sanctuaries, and refuges). The District Engineer must be "notified" (general conditions for notification apply), if the discharge is between 10-25 cubic yards for a single project or the project is in a special aquatic site and less than 1/10 of an acre is expected to be lost. If the values are greater than those given, a permit is required. Beaver dams rarely would exceed 2 or 3 cubic yards of backfill into the waters and probably no more than 5 cubic yards would ever be exceeded. Therefore, this stipulation is not restrictive. Beaver dams periodically may be removed in a special aquatic area, but normally the aquatic site will be returned to normal. However, if a true wetland exists, and beaver dam removal is not allowed under another permit, then a permit must be obtained from the District Engineer.

NWP 27 provides for the discharge of dredge and fill for activities associated with the restoration of wetland and riparian areas with certain restrictions. On non-federal public and private lands, the owner must have: a binding agreement with USFWS or NRCS to conduct restoration; a voluntary wetland restoration project documented by NRCS; or notified the District Engineer according to "notification" procedures. On Federal lands, including Corps and USFWS, wetland restoration can take place without any contract or notification. This NWP "*...applies to restoration projects that serve the purpose of restoring "natural" wetland hydrology, vegetation, and function to altered and degraded non-tidal wetlands and "natural" functions of riparian areas. This NWP does not authorize the conversion of natural wetlands to another aquatic use...*" If operating under this permit, the removal of a beaver dam would be allowed as long as it was not a true wetland (i.e., 5 or more years old), and for non-federal public and private lands the appropriate agreement, project documentation, or notification is in place.

A quick response without delays resulting from permitting requirements can be critical to the success of minimizing or preventing damage. Exemptions contained in the above regulations or NWPs provide for the removal of the majority of beaver dams that TWSP encounters. The primary determination that must be made by TWSP personnel is whether a beaver impounded area has become a true wetland or is just a flooded area. The flexibility allowed by these exemptions and NWPs is important for the efficient and effective resolution of many beaver damage problems because damage can escalate rapidly the longer an area remains flooded.

Water-level control devices (pond levelers) have been used for many years with varying degrees of success. Several devices such as the Three-log Drain (Roblee 1983), the T-culvert Guard (Roblee 1987), wire mesh culvert (Figure 2) (Roblee 1983), and the Clemson beaver pond leveler (Miller and Yarrow 1994) may be used to regulate water levels in beaver ponds. Additionally, the Beaver Deceiver is a water-level control system that attempts to quiet, calm, and deepen the water in front of culverts (i.e., to reduce the attractiveness to beaver) and exclude beaver from a wide area around the upstream opening of the culvert (Lisle 1996). However, the effectiveness of this method has not been evaluated in field trials.

Various types of beaver pond levelers have been described (Arner 1964, Laramie and Knowles 1985, Lisle 1996, Roblee 1984) and installation of beaver pond levelers can be effective in reducing flooding in certain situations, if properly maintained (Minn. Dept. Nat. Res. 1994, Miller and Yarrow 1994). Water-level control devices generally are of two designs. One design is a perforated pipe passing through the beaver dam and the second is a fence erected 15 - 90 feet in front of the culvert to prevent the beaver from blocking the culvert with debris (Lisle 1996.). The second design may include a perforated pipe extending from the fence to the culvert to allow water to continue to flow if the fence becomes clogged with debris.

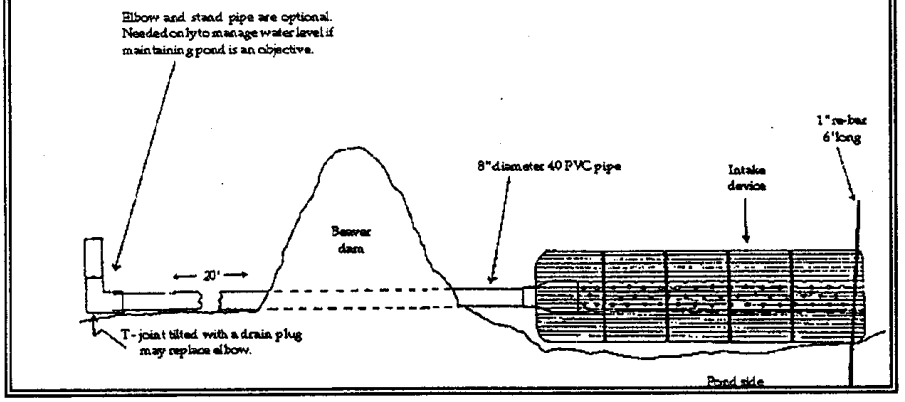
The cost of water-level control devices is variable, depending on number of devices per dam, type of device, materials used, and labor. Dams may need multiple devices to accommodate the volume of water in the flowage. Materials and installation for water-level control devices can be relatively modest for a three-log drain (Arner 1964), $496 - $560 for a single modified Clemson leveler (Nolte et al. 2000), $1050 - $2,300 for a single beaver stop, or more than $1,000 for a Beaver Deceiver. The use of pond levelers or water-level control devices may require frequent maintenance, depending on the type of water-level control device used. Because stream flow, leaf fall, floods, and beaver activity may bring debris to the water-level control device, frequent maintenance is often required (Nolte et al.2003).

Water-level control devices are most effective on wetlands lacking in-stream flow (B. Sloan, USDA/APHIS/WS-MS, pers. comm. 2002) and may be ineffective in beaver ponds located in broad, low-lying areas (Organ et al. 1996). Water-level control devices may not be appropriate in streams or ditches with continuous flow because the volume of water is too great for the device and debris is continuously carried to the site. Similarly, water-level control devices may be ineffective during periods of unusually high rainfall or increased water flow (Wood et al. 1994).

Physical Exclusion

General exclusion pertains to methods that prevent access to resources through fencing or other barriers. Fencing of small critical areas such as around culverts and drain pipes can sometimes prevent beavers from plugging them and around aquaculture facilities can prevent access to otter. Construction of concrete

Figure 2. Pond Leveler



spillways may reduce or prevent damage to dams by burrowing aquatic rodent species. Riprap can also be used on dams or levees at times, especially to deter muskrat burrowing. Electrical water barriers have proven effective in limited situations for beaver; an electrical field through the water in a ditch or other narrow channel, or hot-wire suspended just above the water level in areas protected from public access, have been effective at keeping beaver out. The effectiveness of an electrical barrier is extended when used in conjunction with an odor or taste cue that is emitted because beaver will avoid the area even if the electrical field is discontinued (Kolz and Johnson 1997). Fencing, especially if it is installed with an underground skirt, can prevent access to aquatic mammals to areas such as yards, hay meadows, aquaculture facilities, and poultry barns. Lastly, hardware cloth or other metal barriers can sometimes be practical to prevent girdling and gnawing of valuable trees.

Abrasives are materials that discourage, reduce or prevent gnawing behavior of rodents. Abrasives produce an unpalatable surface which irritates the teeth and mouth of rodents when they attempt to gnaw or chew on the surface. Flexible materials, such as sandpaper, grinder pads and fine-mesh stainless steel screening can be placed on or over objects (e.g., electrical wiring, plastic piping, fruit trees, etc) that are susceptible to rodent gnawing. Fine sand can be added and mixed with paint, glue or other suitable liquid adherents to formulate a paste or heavy mixture that can be brushed-on or applied to a surface to discourage rodent gnawing. This method has had limited success when applied or painted to tree trunks to discourage beaver from cutting down trees. Recent preliminary tests of applying a textural repellent (e.g., sand mixed in paint) by WS' National Wildlife Research Center (Nolte et al. 2003) suggest that this method may be more applicable for large diameter trees. However, additional research is needed to fully evaluate the efficacy and practicality of abrasives.

Wildlife Management

Reducing wildlife damage through wildlife management is achieved through the use of a myriad of techniques. The objective of this approach is to alter the behavior of or repel the target species, remove specific individuals from the population, reduce local population densities, or suppress/extirpate exotic species populations to eliminate or reduce the potential for loss or damage to property and natural resources.

Frightening devices are used to repel wildlife from an area where they are a damage risk to resources such as fish at an aquaculture facilities or crops. The success of frightening methods depends on an animals' fear of, and subsequent aversion to, offensive stimuli. A persistent effort is usually required to effectively apply frightening techniques and the techniques must be sufficiently varied to prolong their effectiveness. Over time, animals often habituate to commonly used scare tactics and ignore them, and in many cases only effective for very local areas (Rossbach 1975, Pfeifer and Goos 1982, Conover 1982 Shirota et al. 1983, Schmidt and Johnson 1984, Mott 1985, Dolbeer et al. 1986, Graves and Andelt 1987, Tobin et al. 1988, Bomford 1990). Additionally, many animals frightened from one location become a problem at another. Scaring devices, for the most part, are directed at specific target species by specialists working in the field. However, several of these devices, such as scarecrows and propane exploders can be automated.

Harassment and other scaring devices and techniques to frighten animals are probably the oldest methods of combating wildlife damage. These devices may be either auditory or visual and generally only provide short-term relief from damage. A number of sophisticated techniques have been developed to scare or harass wildlife from an area. The use of noise-making devices is the most popular and commonly used. Other methods include harassment with visual stimuli (e.g., scarecrows, human effigies, balloons, mylar tape, wind socks), vehicles, lasers, people, falcons or dogs. These are used to frighten mammals from the immediate

vicinity of the damage prone area. As with other WDM efforts, these techniques tend to be more effective when used collectively in a varied regime rather than individually. However, the continued success of these methods frequently requires reinforcement by limited shooting (see Shooting). These are more likely only to be successful for otter, as Jackson and Decker (1993) found them to be ineffective for beaver and muskrat.

Relocation, the translocation of an animal, may be appropriate in some situations (i.e., if the problem species' population is at very low levels, there is a suitable relocation site, and the additional dollars required for relocation can be obtained.) However, those species that often cause damage problems (e.g., beaver) are relatively abundant and relocation is not necessary for the maintenance of viable populations. Relocation may also result in future depredations if the relocated animal encounters protected resources again, possibly triggering payment of damage compensation claims in some cases. Additionally, TPWD would have to authorize relocations before they could be done per Title 5 section 65.378.

AVMA, The National Association of State Public Health Veterinarians, and the Council of State and Territorial Epidemiologist all oppose the relocation of mammals because of the risk of disease transmission, particularly for small mammals such as raccoons or skunks (Center for Disease Control 1990). Relocation of wildlife is also discouraged by WS policy (WS Directive 2.501) because of stress to the relocated animal, poor survival rates, and difficulties in adapting to new locations or habitats. Although relocation is not necessarily precluded, in many cases, it would be logistically impractical and biologically unwise. TWSP has not conducted relocation for any aquatic mammal, but could if deemed an ecologically desirable response to a species crisis in the future. At present, all aquatic mammals in Texas exhibit stable population trends and are abundant in their preferred habitat.

Chemical repellents are nonlethal chemical formulations used to discourage or disrupt particular behaviors of wildlife. There are three main types of chemical repellents: olfactory, taste, and tactile. Olfactory repellents must be inhaled to be effective. These are normally liquids, gases or granules, and require application to areas or surfaces in need of protection. Taste repellents are compounds (i.e., liquids, dusts, granules) aversive to the target animal that are normally applied to trees, shrubs and other materials that are likely to be ingested or gnawed by the target species. Tactile repellents are normally thick, liquid-based substances which are applied to areas or surfaces to discourage travel of wildlife by irritating them or making the area undesirable for travel. Most repellents are ineffective or are short-lived in reducing or eliminating damage caused by wildlife. Therefore, repellants are infrequently used by TWSP. In addition, no proven repellents are currently available for AMDM.

Capture or take methods involve several methods available to capture or take offending animals. The appropriateness and efficacy of any technique will depend on a variety of factors. Many capture methods are nonlethal and the animal could be relocated or euthanized following capture. Most all aquatic mammals are euthanized by TWSP. Lethal damage management involves methods specifically designed to remove aquatic mammals in certain situations to a level that stabilizes, reduces or eliminates damage. Level of removal necessary to achieve a reduction of aquatic mammal damage varies according to the resource protected, habitat, population, effectiveness of other damage management strategies and other ecological factors. Despite the numerous damage management methods developed, trapping remains the most effective method of removing beaver and reducing damage (Hill 1976, Hill et al. 1977, Wigley 1981, Weaver et al. 1985). Intensive trapping can eliminate or greatly reduce beaver populations in limited areas (Hill 1976, Forbus and Allen 1981).

Leg-hold traps can be effectively used to capture a variety of mammals. Leg-hold traps are either placed beside or in travel ways being actively used by target species. Placement of traps is contingent upon habits of the respective target species, habitat conditions and presence of non-target animals. Effective trap and lure placement, adjustment, and use by trained WS personnel contributes to the leg-hold trap's selectivity. An additional advantage is that leg-hold traps can allow for on-site release of non-target animals. Use of leg-hold traps requires more skill than some methods, but leg-hold traps are indispensable in resolving many damage problems. Aquatic mammals live-captured in leg-hold traps are often humanely euthanized.

Snares are capture devices comprised of a cable formed in a loop with a locking device. Snares are often placed in travel ways and equipped with a swivel to minimize cable twisting and breakage. Leg-hold traps can be difficult to keep operational during periods of inclement weather. However, snares are easier and less effected by inclement weather. Target animals are caught around the neck, body, or leg and then humanely euthanized.

Cage traps come in a variety of styles for WDM to target different species. The most commonly known cage traps used in the current program are box traps. Box traps are usually rectangular, made from wood or heavy gauge wire mesh (very heavy gauge for beavers). These traps are used to capture animals alive and can often be used where many lethal or more dangerous tools would be too hazardous. Box traps are well suited for use in residential areas for all the aquatic rodents. Specialized cage traps in the water are more well-suited for otter.

Cage traps do have a few drawbacks. Some individual target animals avoid cage traps. Some nontarget animals become "trap happy" and purposely get captured to eat the bait, making the trap unavailable to catch target animals. These behaviors can make a cage trap less effective. Cage traps must be checked frequently to ensure that captured animals are not subjected to extreme environmental conditions. For example, an animal may die quickly if the cage trap is placed in direct summertime sunlight. Another potential problem with the use of cage traps is that some animals will fight to escape and become injured. Aquatic mammals caught in cage traps are often euthanized. They also could be relocated, if ecologically desirable.

Hancock traps (suitcase/basket type cage traps) are designed to live-capture primarily beaver and otter. This type of trap is constructed of a metal frame covered in chain-link fence that is hinged with springs. Trap appearance is similar to a large suitcase when closed. When set, the trap is opened to allow an animal to enter, and when tripped the sides close around the animal. One advantage of using the Hancock trap is the ease of release of beaver or non-target animals. Disadvantages of these traps are expense (approximately $275 per trap), cumbersome and bulky size, and difficulty to set (Miller and Yarrow 1994). Hancock traps can also be dangerous for humans to set (i.e., hardhats are recommended when setting suitcase traps), are less cost and time-efficient than snares, leg-holds and body-grip traps, and may cause serious and debilitating injury to otters (Blundell et al. 1999). Beaver captured in Hancock traps would be euthanized.

Colony traps are multi-catch traps used to either live-capture or drown muskrats. There are various types of colony traps. One common type of colony trap consists of a cylindrical tube of wire mesh with a one-way door on each end (Novak 1998b). Colony traps are set at entrances to muskrat burrows or placed in muskrat travel lanes. Colony traps are effective and relatively inexpensive and easy to construct (Miller 1994). The stovepipe trap, a common type of colony trap, is usually made with sheet metal and may capture two to four muskrats on the first night (Miller 1994). Muskrats live-captured in colony traps would be euthanized by shooting or with drugs.

Body-grip (e.g., Conibear®) traps are designed to cause quick death of the animal that activates the trap. The number 330 body-grip trap is generally used for beaver and otter, the 330 or 220 for nutria, and the 110 for muskrats. Body-grip traps for beaver capture are used exclusively in aquatic habitats, with placement depths varying from a few inches to several feet below the water surface. Smaller Conibear traps, such as those used for muskrats, can be set either in or out of the water. Placement is in travel ways or at lodge or burrow entrances. Animals are captured as they travel through the trap and activate the triggering mechanism. Safety hazards and risks to humans are usually related to setting, placing, checking or removing the traps. Body-grip traps present a minor risk to non-target animals because of the selectivity of placement in aquatic habitats and below the water surface.

Shooting is the most selective method for removing target species and may involve use of spotlights and shotguns, rifles, or pistols. Shooting is an effective method to remove small numbers of aquatic mammals in damage situations, especially where trapping is not feasible. Removal of specific animals in the problem area can sometimes provide immediate relief from a problem. Shooting is sometimes used as one of the first lethal damage management options because it offers the potential of resolving a problem more quickly and selectively than some other methods, but it does not always work. Shooting may sometimes be one of the only AMDM options available if other factors preclude setting of damage management equipment. TWSP personnel receive firearms safety training to use firearms that are necessary for performing damage management duties.

Firearms use is very sensitive and a public concern because of safety issues related to the public and misuse of firearms. To ensure safe use and awareness, TWSP employees who use firearms to conduct official duties are required to attend an approved firearms safety and use training program within 3 months of their appointment and a refresher course every 3 years thereafter (WS Directive 2.615). Many TWSP employees carry firearms as a condition of employment and are required to certify that they meet the criteria as stated in the *Lautenberg Amendment*. The *Lautenberg Amendment* prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

Zinc phosphide is a toxicant registered in Texas for use in muskrat and nutria damage management. No toxicants are registered for use on beaver or otter. Use of zinc phosphide on various types of fruit, vegetable, or cereal baits (e.g., apples, carrots, sweet potatoes, oats, barley) has proven to be effective at suppressing local populations. All chemicals used by TWSP are registered under FIFRA and administered by EPA and TDA. Zinc phosphide is federally registered by APHIS/WS. Specific bait applications are designed to minimize non-target hazards (Evans 1970). Zinc phosphide presents minimal secondary hazard to predators and scavengers. Zinc phosphide is an emetic; therefore, meat-eating animals such as mink, dogs, cats, and raptors regurgitate animals that are killed with zinc phosphide with little or no effect. No T&E species occurring in TX would be adversely affected by use of this formulated product. WS personnel that use chemical methods are certified as pesticide applicators by TDA and are required to adhere to all certification requirements set forth in FIFRA and Texas pesticide application laws and regulations. A quantitative risk assessment evaluated potential impacts of WS use of chemical methods and found that when pesticides are used according to their labeling, no adverse effects are expected from them including zinc phosphide (USDA 1997).

Chemical immobilizing and euthanizing drugs are important tools for managing wildlife. Under certain circumstances, TWSP personnel are involved in the capture of animals where the safety of the animal, personnel, or the public are compromised and chemical immobilization provides a good solution to reduce

these risks. For example, chemical immobilization has often been used to take animals in residential areas where public safety is at risk. TWSP employees that use immobilizing and euthanizing drugs are certified for their use and follow the guidelines established in the WS Field Operational Manual for the Use of Immobilization and Euthanasia Drugs. Telazol® (tiletamine), and Ketamine/Xylazine are immobilizing agents often used by TWSP to capture and remove predators and other animals. These are typically used in urban, recreational, and residential areas where the safe removal of a problem animal is most easily accomplished with a drug delivery system (e.g., darts from rifle, pistol, or blow gun, or syringe pole). Immobilization is usually followed by relocation when appropriate or euthanasia. Euthanasia is usually performed with drugs such as Beuthanasia-D® or Fatal-Plus® which contain forms of sodium phenobarbital. Euthanized animals are disposed of by incineration or deep burial to avoid secondary hazards. Drugs are monitored closely and stored in locked boxes or cabinets according to WS policies, and Department of Justice, Drug Enforcement Administration guidelines. Most drugs fall under restricted-use categories and must be used under the appropriate license from the U.S. Department of Justice, Drug Enforcement Administration which TWSP does holds. It is WS' conclusion that the use of immobilizing and euthanizing drugs will have no effect on T&E species because they are highly target specific.

3.2.2 Alternative 2 -Technical Assistance Only.

This alternative would not allow TWSP to conduct operational AMDM in Texas. TWSP would only provide technical assistance and make recommendations when requested. Resource owners could conduct AMDM activities including the use of leghold, body gripping, and cage traps, snares, shooting, zinc phosphide (with proper licensing from TDA) and any nonlethal methods they deemed effective per Texas Parks and Wildlife Code. Methods and control devices could be applied by persons with little or no training and experience. Consequently, this could require more effort and cost to achieve the same level of problem resolution. If resource owners become frustrated, they are likely to resort to unconventional methods that could cause harm to the environment, result in greater take of nontarget animals, and/or increased risks to public safety.

3.2.3 Alternative 3 -Nonlethal AMDM Only.

This alternative would not allow the recommendation or use of lethal methods by TWSP as described under the proposed action. TWSP would be allowed to use nonlethal control measures including all methods used in AMDM, except: quick-kill traps, shooting, zinc phosphide, and euthanasia drugs. Other capture techniques such as snares and leghold traps would have to be used nonlethally. Because TWSP would not be as responsive to the requesters needs, some resource owners would be left to their own accord to stop damage. Resource owners or managers would still have the option of implementing nonlethal and lethal control measures without assistance from TWSP.

3.3 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

Several alternatives were considered but not analyzed in detail. These were not considered because of problems associated with their implementation.

3.3.1 No Federal WS AMDM.

This alternative would consist of no federal involvement in AMDM in Texas. Due to its cooperative structure, TWSP would not be able to provide direct operational management or technical assistance for AMDM issues under this alternative. However, major conflicts would still arise among major state, county,

and private entities, which support the continued need for AMDM currently funded primarily through state appropriations to Extension and county government appropriations to TDMA. It is probable that some level of AMDM would be implemented, either by another Division within The Texas A&M University System or other state agency, but at a lower level because the entity would have to replace federal funds and personnel currently utilized to provide administrative duties, supervision, and equipment necessary to conduct these activities. Limited assistance would, in many cases, leave resource owners to resolve their own problems with little guidance. In other words, it would be left up to resource owners to conduct AMDM under this scenario. If this were the case, some AMDM methods would likely be used unsafely and improperly, such as the illegal use of pesticides and traps, simply out of frustration by resource owners unable to reduce damage losses to a tolerable level.

After careful consideration, TWSP has concluded that, whereas:

79% of TWSP's field employees are employees of the State of Texas, through Extension-WS;

82% of field employees are stationed in areas of the state inhabiting aquatic mammals, thereby potentially conducting AMDM, and are funded by the State to provide multi-faceted services to Texas residents requiring response to other WDM concerns, including: zoonotic disease monitoring; rabies research; participation and cooperation with other state agencies to form the Texas Response Team enacted to eliminate the introduction and spread of foreign animal diseases, such as Chronic Wasting Disease, West Nile Virus, and Exotic Newcastle Disease; wildlife hazard management at civil and military airport facilities; protection of T&E species; predator and avian management; and other duties as determined by TWSP and local officials as pertinent WDM needs;

field employees are stationed throughout the State to concurrently address AMDM with other WDM issues, at the local level;

addressing AMDM needs immediately significantly reduces monetary damage and property losses, especially from flooding, incurred by Texas residents, businesses, and municipalities;

addressing AMDM needs immediately significantly reduces losses to the transportation industry by reducing undermining and erosion of roads, bridges, and railroad trestles attributed to aquatic mammal activity;

inability to address AMDM would expand range of damage to include many residents, property, structures, roadways, and railroad trestles previously not exposed to aquatic mammal damage, thus easily increasing state damage figures by millions of dollars annually;

the State of Texas has declared a need for AMDM and provided legislative appropriations to conduct AMDM for Texas residents;

Texas Health and Safety Code, Ch 825, Subchapter A, directs The Texas A&M University System to cooperate with federal officers to conduct WDM, resulting in the current MOU establishing TWSP as the lead agency responsible for WDM; no provision was made allowing TWSP to be discriminatory in which facets of WDM they will address and, thereby, TWSP would be negligent in their obligation to operate and uphold the resulting MOU;

inability to respond to AMDM requests, a legitimate WDM issue for a major portion of the state, would constitute negligence by TWSP to uphold mandated responsibilities stated within the MOU, jeopardizing the existence of TWSP, its cooperative structure, and all WDM services it currently provides to the residents of Texas;

therefore, this alternative, more than any other alternative analyzed in this EA, would not add to the analysis because it is likely that the State would do it anyway, but without federal oversight or participation. Since most funds are appropriated by the State, it is likely that this alternative would have similar conclusions as the current program. Additionally, employees would not have the ability to attend training programs given by the national WS Program, such as explosives and firearms training. Thus, this alternative will not be considered further by TWSP in this EA.

3.3.2 Compensation for Aquatic Mammal Damage Losses.

Compensation would require the establishment of a system to reimburse resource owners for damages. This alternative was eliminated from further analysis because no federal or state laws exist to authorize such action. Under such an alternative, TWSP would not provide any direct control or technical assistance. Aside from lack of legal authority, analysis of this alternative in USDA (1997) indicates that the concept has many drawbacks such as:

- It would require larger expenditures of money and manpower to investigate and validate all losses, and to determine and administer appropriate compensation. Based on data for damage prevented from other WS programs, compensation could be expected to cost about 7 times as much as the current program (WS 2003).

- It would be difficult, if not impossible, to assess and confirm losses in a timely manner for all requests, and, therefore, many losses could not be verified and would go uncompensated.

- Compensation would give little incentive to resource owners to limit damage with AMDM strategies such as improved barriers.

- Not all resource owners would rely completely on a compensation program and AMDM activities including lethal control would likely continue as permitted by state law.

- Compensation would likely be below the full market value of the resource damaged.

3.3.3 Bounties.

Payment of funds for killing aquatic mammals (bounties) suspected of causing economic losses has not been supported by Texas State agencies such as TPWD as well as most wildlife professionals for many years (Latham 1960). TWSP concurs with these agencies and wildlife professionals because of several inherent drawbacks and inadequacies in the payment of bounties, including:

- Bounties are generally ineffective at controlling damage, especially over a wide area such as Texas.

- Circumstances surrounding the take of animals are typically arbitrary and completely unregulated.

- It is difficult or impossible to assure that the animals claimed for bounty were taken from the damage management area.

- TWSP does not have the authority to establish a bounty program. A few counties in Texas do have the option of creating bounty programs per Texas statutes.

3.3.4 Eradication and Long Term Population Suppression.

An eradication alternative would direct all TWSP efforts toward total long-term elimination of aquatic mammals in entire cooperating counties or larger defined areas in Texas. In Texas, the eradication of beaver and muskrat is not a desired goal of state agencies, although these species may be taken by the general public in areas where they are causing damage. Eradication as a general objective for AMDM will not be considered by TWSP in detail because:

- TWSP and TPWD opposes eradication of any native wildlife species;

- The eradication of a native species or local population would be extremely difficult, if not impossible to accomplish, and cost-prohibitive in most situations; and

- Eradication is not acceptable to most members of the public.

Suppression would direct TWSP efforts toward managed reduction of certain problem populations or groups. When a large number of requests for WDM are generated from a localized area, TWSP would consider suppression of the local population or groups of the offending species, if appropriate. However, it is not realistic, practical, or allowable under present WS policy to consider large-scale population suppression as the basis of TWSP. Typically, TWSP activities in Texas are conducted on a small portion of the area inhabited by aquatic mammals and therefore suppression is usually only very localized.

3.3.5 Reproduction Control.

A review of research evaluating chemically induced and surgically induced reproductive inhibition as a method for controlling nuisance beaver populations is contained in Novak (1998a). Although these methods were found to be effective in reducing beaver reproduction by up to 50%, the methods were not found to be practical or were too expensive for large-scale application. At present, no chemical reproductive inhibitors are legal for use for aquatic mammals. For these reasons, this method will not be considered further by TWSP.

3.3.6 Biological Control.

The introduction of a species or disease to control another species has occurred throughout the world. Unfortunately many of the introduced species become pests themselves. For example, in Hawaii, the Indian mongoose (*Herpestes auropunctatus*) was brought in to control rats (*Rattus spp.*), but wound up causing declines in many native Hawaiian bird species. The only biological control that has been tried for managing aquatic mammals is the introduction of alligators (Wade and Ramsey 1986). Although alligators can and do sometimes prey on aquatic mammals, they would be unreliable in reducing numbers to the point that damage no longer occurred. In addition, alligators are already native to much of the range for aquatic mammals in

Texas and have not impacted their populations. Since this method nor any other biological control method has been effective and environmentally safe, this will not be considered further by TWSP.

3.3.7 Nonlethal Required Before Lethal Control.

This alternative would not allow the use of lethal methods by TWSP as described under the proposed action until nonlethal methods had been attempted to relieve damage caused by aquatic rodents and found to be ineffective or inadequate. Resource owners or managers would still have the option of implementing nonlethal and lethal control measures and TWSP would continue to recommend them where appropriate, but no preventive lethal control by TWSP would be allowed. However, WS Policy requires TWSP Specialists to consider and prefer nonlethal over lethal AMDM methods while assessing a damage situation and applying the WS Decision-making Process (Slate et al. 1992). Additionally, TWSP personnel experienced in AMDM know when and where nonlethal control techniques would be effective or ineffective, and, thus, this alternative could result in the use of methods that are known to be ineffective in particular situations just to meet the requirements. This would also take additional time to resolve a problem and potentially exacerbating the damage sustained by a resource owner before a problem was resolved. This Alternative has been discussed in detail in USDA (1997) and other WS EAs such as the Aquatic Rodent Damage Management in Oklahoma EA (WS 1998). This alternative has always been found to have slightly higher negative environmental impacts than implementing IWDM, the proposed action. Therefore, this alternative was dropped from analysis in this EA.

3.4 MITIGATION AND SOPs FOR WDM TECHNIQUES

3.4.1 Mitigation in SOPs.

Mitigation measures are any features of an action that serve to prevent, reduce, or compensate for impacts that otherwise might result from that action. The current WS Program, nationwide and in Texas, uses many such mitigation measures which are discussed in detail in Chapter 5 of USDA (1997). Some key mitigating measures pertinent to the proposed action and alternatives that are incorporated into TWSP's SOPs include the following:

- The WS Decision Model (Slate et al. 1992), which is designed to identify effective WDM strategies and their impacts, is consistently used.
- A nontarget animal captured in a leghold trap or snare will be released, if it can be done safely, unless it is determined by TWSP Specialists that the animal will not survive.
- Conspicuous, bilingual warning signs alerting people to the presence of traps and snares are placed at major access points to areas where they are set in the field.
- Reasonable and prudent alternatives and measures are established through consultation with USFWS and implemented to avoid adverse impacts to T&E species.
- Nonlethal WDM methods are to be used preferentially over lethal methods where they would be effective in resolving a damage situation in a timely manner.

Some additional mitigating factors specific to the current TWSP AMDM program include the following:

- Management actions are directed toward localized populations or groups of target aquatic mammal species or individual offending members of those species. Generalized population suppression across Texas will not be conducted.

- Although hazards to the public from AMDM devices and activities are low according to a formal risk assessment (USDA 1997, Appendix P), hazards to the public and their pets are even further reduced by the fact that AMDM activities are primarily conducted on private properties in Texas where public access is highly restricted or denied.

3.4.2 Additional Mitigation Specific to the Issues.

The following is a summary of additional mitigation measures that are specific to the issues listed in Chapter 2 of this document.

3.4.2.1 Effect on Target Aquatic Mammal Species Populations. AMDM activities to resolve damage problems are directed at taking action against native individual problem animals, or local populations or groups, and not by attempting to eradicate populations in the entire area or region.

TWSP take is monitored annually to maintain the magnitude within levels desired or authorized by State agencies representing the State's interests in terms of managing or controlling affected species (See Chapter 4).

3.4.2.2 Effects on Nontarget Species Populations Including T&E Species. TWSP personnel are highly experienced and trained to select the most appropriate method(s) for taking problem animals with little impact to nontarget animals.

TWSP specialists use trap lures and set traps in locations that are conducive to capturing the target animal, but minimize potential impact to nontarget species.

The nationwide WS program engaged in formal consultation with the USFWS pursuant to Section 7 the Endangered Species Act and received a Biological Opinion in 1992 (see USDA 1997, Appendix F and P). That opinion is incorporated herein by reference. However, it did not cover the potential effects of beaver dam breaching on listed species. To address these other concerns, TWSP consulted with USFWS about the potential impacts of AMDM activities on T&E species in Texas in 1998 and 1999. TWSP presented a Biological Assessment and USFWS provided a letter of concurrence with specific mitigation measures so that the T&E species listed would not likely be adversely affected by AMDM. WS abides by those mitigation measures.

TWSP determined that the T&E species that could potentially be negatively impacted by WDM, as discussed in the formal consultation of 1992 (USDA 1997), in Texas are the bald eagle and whooping crane. However, it was determined by the USFWS that the whooping crane would not be adversely affected by current TWSP AMDM activities. Reasonable and prudent alternatives and mitigation measures and their terms and conditions from the 1992 Biological Opinion (USDA 1997, Appendix F) for bald eagles as related to the proposed action and alternatives described in this EA are as follows.

TWSP personnel will contact either the local TPWD office or the appropriate USFWS regional or field office to determine nest and roost locations for bald eagles.

The appropriate USFWS office shall be notified within five days of the finding of any dead or injured bald eagle. Cause of death, injury, or illness, if known, would be provided to those offices.

When bald eagles are in the immediate vicinity of a proposed WDM program, TWSP personnel will conduct daily checks for carcasses or trapped individuals.

TWSP determined that additional T&E species could potentially be negatively impacted by AMDM and were not discussed in the formal consultation of 1992 (USDA 1997). These additional species included the ocelot (*Felis pardalis*), jaguarundi (*Felis yagouaroundi cacomitli*), and the Houston toad (*Bufo houstonensis*). Mitigation measures to avoid adverse impacts to these species are discussed below. Additionally, it was determined that TWSP could have positive benefits for several listed species that prefer flowing creeks with rocky runs and riffles. Additionally, certain species of plants potentially prone to flooding or overgrazing would benefit from AMDM. For example, TWSP conducted a nutria control project for the protection of Texas wild rice, an endangered species, because nutria were severely overgrazing remaining stands.

For the protection of the ocelot and jaguarundi, TWSP will only use shooting and cage traps, checked daily before 10:30 a.m. and sterilized before reuse if a sick animal had been captured, in occupied territories (3-mile radius around confirmed cat sightings and corridors between territories) as defined in the Biological Opinion from USFWS (September 11, 1997 - Consultation No. 2-11-89-F-134) dedicated to the two cat species.

In the present range of the ocelot, each property will be inspected for potential ocelot habitat. If present, neck snares will not be used, #3 leg-hold , #3½ rubber-jawed traps or smaller and aquatic (underwater) set traps could be used unless it is definitively determined that ocelots are on the property. If ocelot habitat is not found on the premise, all AMDM methods could be used.

TWSP will not remove beaver dams in the range of the Houston toad.

For the protection of several T&E plants, TWSP will not create or expand access routes to areas to conduct AMDM.

3.4.2.3 Humaneness of Control Techniques. TWSP personnel attempt to kill captured target animals that are slated for lethal removal as quickly and humanely as possible. In most field situations, a shot to the brain with a small caliber firearm is performed which causes rapid unconsciousness followed by cessation of heart function and respiration. This is in concert with the AVMA's (1986) definition of euthanasia.

- Research on selectivity and humaneness of management practices would be monitored and adopted as appropriate.

- TWSP specialists recommend the use of various nonlethal methods such as exclusion and pond levelers where these are applicable.

- The use of traps and snares conform to current laws and regulations administered by TPWD, TWSP, and WS policy (WS Directive 2.450).

- TWSP' use of AMDM capture devices is consistent with internationally recognized humane trap standards.

3.4.2.4 Effects of Beaver Dam Removal on Wetlands. TWSP AMDM activities do not affect "wetlands" as defined in Swampbuster or CWA. Most AMDM activities involve breaching of beaver dams from recent beaver activity which has flooded areas for a short time or man-made structures including culverts under roads and irrigation structures. Wetlands are not affected in either case.

- Beaver dam removals do not alter the existing drainage system. Hand removal and removal of dams using binary explosives only serve to restore existing drainage to streams, creeks, small river, and irrigation systems. Dam removals are generally not necessary nor conducted on major river systems.

- TWSP Specialists remove beaver dams in accordance with federal and state laws and regulations for environmental protection. These activities will have no impact on wetland wildlife habitat because wildlife habitat often takes several years to develop.

- Property owners will be required to obtain dam removal Section 404 permits from the Corps for areas determined to be wetlands, for dams that have more than 10 cubic yards of fill associated with them, or if the project would alter the waters into a use it was previously not subject, and also where the flow or circulation of waters would be impaired or the reach of the waters reduced.

- Binary explosives are used by TWSP Explosives Technicians trained and certified in beaver dam removal. WS policies and training emphasize using the minimum amount of explosives necessary to remove the dam. This practice minimizes disturbance to wetland habitat, prevents fill from relocating off-site, and minimizes stream born particles within the water. A positive result of using exlposives is that debris is largely scattered over a wide area, preventing a concentrated deposit of material in the waterway channel. Silt loads associated with dam removal are of short duration and generally do not exceed silt levels associated with spring run-off.

- WS' standard operating procedures (SOP's)provide that hand removal of dams is the first choice, when practical, to breach or remove a beaver dam, followed by the use of binary explosives.

- Wildlife habitat, including T&E species, can benefit from AMDM. In low gradient streams, beaver dams increase siltation above the dam, choking out aquatic insect habitat and nesting habitat for several fish species. Coordinated resource management would recognize the benefits of dam removals along with short-term changes in site specific hydrology.

- AMDM does not remove habitat for fish species, but removal of dams does return the water course to its original state. This can benefit fish by protecting streamside vegetation, removing siltation of stream bottoms and reducing vulnerability to predators.

- Several of the T&E fish in Texas (ie. the Big Bend gambusia (*Gambusia gaigei*) and Clear Creek gambusia (*G. heterochir*)), are associated primarily with springs and their outflows where AMDM activities rarely occur. If a beaver flooded these areas, it may be beneficial for the dam to be removed to protect them.

3.4.2.5 Effects of AMDM Methods on Public Safety. TWSP AMDM methods are implemented by trained professionals. WS policies regarding use of specific methods minimize exposure of these methods to the public. Warning signs are placed where traps or snares are used to further reduce public safety concerns.

- AMDM on public lands is coordinated with the public land management agency to identify areas of concern. Projects which might expose the public to safety risks are modified accordingly.

- AMDM on private lands is conducted with signed Agreements for Control which notify the landowner/manager of any possible risks.

- Binary explosives are used by the TWSP program for beaver dam removal. These explosives pose minimal risks during transportation and storage. Bureau of Alcohol, Tobacco, Firearms, and Explosives, Department of Transportation, Occupational Safety and Health Administration, and Agency regulations and guidelines, as well as industry standards, are followed regarding use and storage of all explosive materials.

- Only trained and certified explosive specialists are authorized to transport and store explosive components. WS policies regarding explosive use are mandated. Recertification occurs every 2 years.

- TWSP uses firearms to shoot aquatic mammals and euthanize animals caught in traps. TWSP personnel are trained and given refresher courses to maintain awareness of firearm safety and handling as prescribed by WS policy. Therefore, no adverse impacts to public safety are expected from the use of firearms by TWSP in Texas.

- TWSP Specialists will be trained and supervised in the use of AMDM methods, including firearms, watercraft, explosives, traps, and vertebrate pesticides to ensure that they are used properly and according to policy.

- TWSP Specialists using restricted-use vertebrate pesticides will be certified according to EPA, TDA, and Texas State laws and will use them according to their label restrictions.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

Chapter 4 provides the information needed for making informed decisions in selecting the appropriate alternative for meeting the purpose of the proposed action. This chapter analyzes the environmental consequences of each alternative discussed in Chapter 3 in relation to the issues identified for detailed analysis in Chapter 2.

4.1 ENVIRONMENTAL CONSEQUENCES

This section analyzes the environmental consequences of each alternative in comparison with the proposed action to determine if the real or potential impacts are greater, lesser or the same.

4.1.1 Cumulative and Unavoidable Impacts

Cumulative and unavoidable impacts will be discussed in relationship to each of the potentially affected species analyzed in this chapter.

4.1.2 Nonsignificant Impacts

The following resource values within Texas are not expected to be significantly impacted by any of the alternatives analyzed: soils, geology, minerals, floodplains, visual resources, air quality, or prime and unique farmlands. These resources will not be analyzed further.

4.1.3 Irreversible and Irretrievable Commitments of Resources

No irreversible or irretrievable commitments of resources are expected, other than minor fossil fuel usage for vehicles and/or other similar materials. These will not be discussed further.

4.2 ISSUES ANALYZED IN DETAIL

4.2.1 Effects on Target Aquatic Mammal Populations

NEPA requires federal agencies to determine whether their actions have a "significant impact on the quality of the human environment." A declining population of a resident wildlife species on a local level does not necessarily equate to a "significant impact" as defined by NEPA if the decline is collectively condoned or desired by the people that live in the affected human population. It is reasonable and proper to rely on the representative form of government within a state as the established mechanism for determining the "collective" desires or endorsements of the people of a state. TWSP abides by this philosophy and defers to the collective desires of the people of the State of Texas by complying with State laws and regulations that govern the removal or take of resident wildlife. Although the analysis herein indicates no negative impacts to aquatic mammal populations, should a decline occur in the future, it would not constitute a "significant" impact, as defined by NEPA, if actions causing the decline are in accordance with State law, and concomitantly, the collective desires of the people of Texas.

In addition to take by TWSP, take by sportsmen is also considered. Take of furbearers by trappers and the number of licensed trappers in Texas have declined significantly since the 1993-94 season. Figure 3 gives the number of licensed trappers and take of different aquatic mammal species. Decline in the number of trappers is directly proportional to declines in fur value.

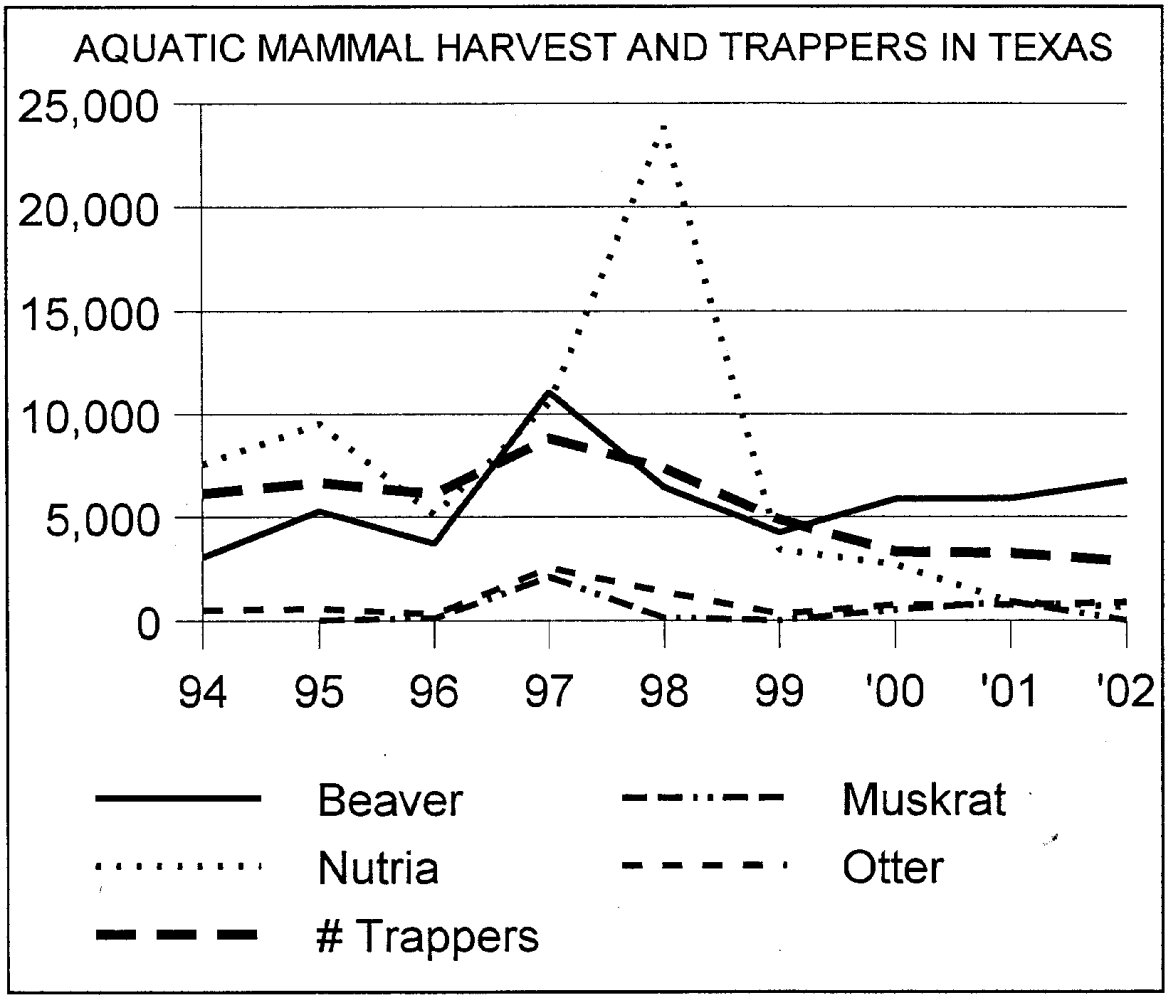


Figure 3. Aquatic mammal harvest by trappers and the number of trapping licenses sold in Texas from the 1993-94 fur season to 2001-02 fur season.

4.2.1.1 Alternative 1 - Continue the Current TWSP AMDM Activities. To adequately determine the impacts this alternative would have on aquatic mammals, their populations need to be analyzed. The authority for management of resident wildlife species has traditionally been a responsibility left to the states. TPWD is the state agency with management responsibility over animals classified by state law as protected furbearers. TPWD provided statistics on population trends and take, but was unable to provide any definitive estimates of population sizes for purposes of the following analyses on impacts to the population. Therefore, TWSP used TPWD trend data and the best available information to produce reasonable estimates of aquatic mammal populations.

Beaver Population Impact Analysis. To discuss the impacts of various environmental constraints and external factors on beaver population and density, it is essential to understand the basic mechanisms that play a role in beaver response to constraints and actions. This wildlife species is often characterized by biologists and managers as having the unique ability to modify its environment, creating habitat to meet its own needs. As mentioned, beaver damage has significantly increased and damage requests have increased since 1994 in Texas. Beaver damage management is, therefore, a major focus of TWSP AMDM efforts in Texas. Beavers occur mostly in family groups that are comprised of 2 adult parents with 2-6 offspring from the

current or previous breeding season, including kits and non-breeding adults (Novak 1998a). Average family group size has been documented as ranging from 3.2 to 8.2 (Novak 1998a). The number of beavers per family in Texas would probably be at least at the midpoint of the range or 6.7 beavers per family.

Beaver abundance has been reported in terms of families per kilometer of stream or per square kilometer surface area for bodies of water. Novak (1998a) summarized reported beaver family abundance as ranging from 0.5 - 2.4 families per mile of stream and from 0.24 to 6.3 families per mile^2 for bodies of water. The wide variation is attributed to the quality of the habitat. Texas probably has beaver densities at the high end in east Texas and mid range densities for the remainder of the state, as summarized by Novak (1998a). The professional opinion of wildlife biologists at TPWD and TWSP suggests that the present statewide beaver population is at least mid range for surface area of water given in Novak (1998a), but may be higher. This would suggest that Texas has 1.5 families/mile of stream and 3.3 families/mile^2 surface area of water.

Texas has a good supply of water resources, ranking 6th among the 50 states in surface acres of water. As discussed, the state of Texas has 191,228 miles of streams and rivers and about 4,700 mile^2 in surface area. With these estimates, the beaver population could be estimated with the following formula:

*(beavers/family * # beaver families/mile of stream * miles of streams in TX) + (beavers/family * # beaver families/mi^2 of impoundments * surface mi^2 in TX)*

or

*(6.7 * 1.5 * 191,228) + (6.7 * 3.3 * 4,700) = 2,025,758*

Using the low density figures as a conservative estimator, 0.5 families/mi stream and .24 families/mi^2 surface water, but still assuming the family size at the midpoint, the population estimate would be 716,190 beavers. These population estimates can be used to determine the impacts of TWSP take of beaver on the population (Table 2). Included in Table 2 is TWSP's take and the statewide harvest, including sportsman harvest. However, landowners can take depredating beavers yearround without a permit, so estimates of beaver taken by them cannot be estimated by TPWD or TWSP.

Table 2 summarizes the analysis of TWSP and cumulative impacts on the beaver population. TWSP killed 4,386 beavers in FY00, 3,456 in FY01, and 3,831 in FY02.Additionally, TWSP took 2 nontarget beaver incidental to otter and nutria damage management in FY02. Private harvest of beaver as reported by the TPWD was 5,889 during the 1999-2000 season, 5,913 in the 2000-01 season, and 6,755 in the 2001-02.season

Table 2. Analysis of cumulative beaver take in Texas including take by TWSP and private trappers for FY00, FY 01, and FY02.

Beaver Pop.	Low Estimate	High Estimate	Low Estimate	High Estimate	Low Estimate	High Estimate
Fiscal Year	FY00		FY01		FY02	
Est. Pop.	700,000	2,000,000	700,000	2,000,000	700,000	2,000,000
TWSP Take	4,386	4,386	3,456	3,456	3,833	3,833
% Pop.	0.6%	0.2%	0.5%	0.2%	0.5%	0.2%
Est. Fur Take	5,889	5,889	5,913	5,913	6,755	6,755
% Pop.	0.8%	0.3%	0.8%	0.3%	1.0%	0.3%
Total Take	10,275	10,275	9,369	9,369	10,588	10,588
% Pop.	1.5%	0.5%	1.3%	0.5%	1.5%	0.5%
Impact	Low	Low	Low	Low	Low	Low

USDA (1997) determined that beaver populations can withstand harvest rates of up to 30% without declining. The highest take by TWSP, in FY02, represented 0.5% of the estimated beaver population. The estimated total beaver take during FY02, 10,586, was the highest cumulative take recorded (TWSP and private trappers), or 1.5% of the minimum population estimate of 700,000 beavers. This level of take represents a low impact to the estimated beaver population. An allowable harvest for the low population estimate would be over 210,000. If landowners theoretically took 100,000 beaver per year (which is very unlikely), the take would still not be significant. Thus, cumulative take appears to be well beneath the level that would begin to cause a decline in the population. Therefore, TWSP' take and the cumulative impact on the beaver population is considered to be of extremely low magnitude. TWSP concludes that beaver have not been negatively impacted by TWSP activity.

Nutria Population Impact Analysis

Nutria are distributed along surface water streams, rivers, reservoirs and wetlands (both freshwater and brackish marshes) of the eastern 2/3 of the State (Wade and Ramsey 1986). Kinler et al. (1987) summarized reported density estimates which ranged from 0.6 to 138 nutria per hectare (0.3 to 56 per acre). Nutria populations densities are highest in freshwater marshes (Kinler et al. 1987).

For purposes of this analysis, it is conservatively assumed that nutria densities are at the lower end of the range of estimates shown above (0.3 per acre) and that this density occurs throughout 2/3 of the 8 million acres of wetland habitat that exist in the State. This would equate to at least 1.6 million nutria in Texas. This would be a very conservative estimate.

Table 3. Analysis of cumulative nutria take in Texas including take by TWSP and private trappers for FY00, FY 01, and FY02.

Nutria Pop.	High Estimate	Low Estimate	High Estimate
Fiscal Year	**FY00**	**FY01**	**FY02**
Est. Pop.	1,600,000	1,600,000	1,600,000
TWSP Take	900*	297**	1,650*
% Pop.	0.06%	0.02%	0.10%
Est. Fur Take	2,712	913	664
% Pop.	0.17%	0.06%	0.04%
Total Take	3,612	1,210	2,314
% Pop.	0.23%	0.08%	0.14%
Impact	Low	Low	Low

* Zinc phosphide used in FY00 (6 oz) and FY 02 (11 oz) with take estimated at 150 nutria per ounce used. One ounce makes approximately 150 baits and it is assumed, for the purposes of this analysis, that each bait was eaten by a separate nutria and was 100% effective. This would be a very high estimate to err on the side of being conservative. **Conversely, no Zinc Phosphide was used by TWSP in FY 01, therefore TWSP take is actual take recorded from all other methods, providing a low estimate.

TWSP harvested 485 nutrias in FY00, 297 in FY01, and 331 in FY02 (Table 3). In addition, 6 ounces of zinc phosphide was used in FY00 and 11 ounces in FY02. For the purposes of this analysis, take can be estimated using a factor of 150 nutria/ounce of zinc phosphide, as one ounce of zinc phosphide makes approximately 150 baits. This would likely be a very high estimate because one nutria could conceivably eat more than one bait and/or not all baits may have been consumed at a treatment site. TWSP also took nutria as nontargets incidental to beaver damage management, 21 in FY00, 17 in FY01, and 14 in FY02. Fur trappers harvested 2,712 nutria in the 1999-2000 season, 913 in 2000-01, and 664 in 2001-02. These harvest figures are down from prior years because fur prices dropped. For comparison, the 1997-98 fur season harvested almost

24,000 nutria. Current cumulative take is far below this level and was highest in FY00 at 0.32% of the population. Even the cumulative take in FY98 would have only been 1.5% of the population.

USDA (1997) did not determine a sustainable harvest level for nutria, primarily because it is not a native species and not generally managed as a game animal by state wildlife agencies. A harvest level of over 50% would likely be an acceptable harvest rate for nutria because they have high reproductive potential. Females typically become sexually mature at as young as 4 months of age, have pregnancy rates ranging from 58 to 100%, average litter size of 4.7 young (range from 1 to 13), and can produce 2 litters per year (Kinler et al. 1987). Being highly prolific, a population would produce more young annually than the number in the population. A harvest rate in Texas of 800,000 nutria would likely produce no ill-effects on the population. Therefore, under these highly conservative assumptions, the total take of nutria is of extremely low magnitude. In addition, nutria take by TWSP is considered to be of no significant impact on the human environment since nutria are not an indigenous component of ecosystems in Texas and, thus, the environmental baseline could be considered zero.

Muskrat Population Information and Impact Analysis

Muskrats occur mainly in east Texas along the gulf coast, and in northeast Texas continuing into the panhandle region. They also occur along the Pecos River and the Rio Grande River north and west of Big Bend National Park. They do not occur in much of central and west Texas (Wade and Ramsey 1986). They reside in freshwater and brackish marshes, ponds, sloughs, lakes, ditches, streams, and rivers (Boutin and Birkenholz 1998).

TPWD does not estimate muskrat populations in the State. However, muskrats are highly prolific, producing 3-4 litters per year and averaging 5-8 young per litter (Wade and Ramsey 1986). Boutin and Birkenholz (1998) stated these characteristics contribute to muskrats possessing relative immunity to overharvesting and reported sustainable harvest rates of 3 - 8 per acre. Assuming that muskrats occupy only a twentieth of the 8 million acres of wetlands in the state, then harvests totaling more than 1.2 million per year could be sustainable. Muskrats do not cause substantial damage problems in Texas and the TWSP did not take any muskrats for depredation purposes from FY 00 to FY02 but has conducted minor projects in the past. TPWD reported harvest for 1999-2000 furbearer season at 537, for 2000-01 at 921, and only 8 in 2001-02. Muskrats harvested on private lands is unknown. Clearly, the mortality resulting from fur harvest or damage control would have a negligible impact on the population and be considered of very low magnitude.

River Otter Population Impact Analysis

River otters are known to occur primarily in the eastern and southeastern counties of Texas, in both marine and freshwater environments. Population densities appear greatest in food-rich coastal regions, including estuaries, lower portions of streams, and coastal marshes, and they typically occur in inland areas where lowland marshes and swamps interconnect with meandering steams and small lakes (Melquist and Dronkert 1998).

Melquist and Dronkert (1998) summarized studies that estimated river otter densities at about 1 per 175-262 acres in Texas coastal marshes, and ranged from 1/1.8 miles to 1/3.6 miles of waterway (stream or river). TPWD does not estimate the otter population, but monitors its trend with bridge surveys and have concluded that otter populations are stable (TPWD 2003). However, in the absence of a population estimate by TPWD, the otter population could be estimated conservatively for Texas with population information. Assuming that otters occupy a fifth of the waterways in Texas (191,228/5 stream/river miles and 4,700 mi^2/5 surface area of ponds/lakes), and that densities are low at 1/3.6 miles of stream and 1/262 acres surface area, a population

of 12,919 or about 13,000. A more realistic population estimate would likely be the midpoint of these density estimates or 1/2.7 miles of stream and 1/219 surface acres and would equal 16,912 or about 17,000.

TWSP takes river otter for depredation problems and as nontargets, incidental to beaver and nutria damage management activities. In FY00, TWSP took 132 (69 target, 63 nontarget), 81 in FY 01 (24 target, 57 nontarget), and 98 otters in FY 02 (12 target, 86 nontarget). During the same time, fur trappers took 772 in the 1999-2000 fur season, 761 in the 2000-01 season, and 904 in 2001-02 season. It is unknown how many otter were taken by private landowners for depredations. Thus, the known cumulative take represented almost 8% of the conservative otter estimate.

Table 4. Analysis of cumulative otter take in Texas including take by TWSP and private trappers for FY00, FY 01, and FY02.

Otter Pop.	Low Estimate	Low Estimate	Low Estimate
Fiscal Year	FY00	FY01	FY02
Est. Pop.	13,000	13,000	13,000
TWSP Take	132	84	98
% Pop.	1.02%	0.65%	0.75%
Est. Fur Take	772	761	921
% Pop.	5.94%	5.85%	7.08%
Total Take	904	845	1,019
% Pop.	6.95%	6.50%	7.84%
Impact	Low	Low	Low

The highest take of otter by sportsmen in recent times was in the 1996-97 fur season at 2,532 or about 20% of the conservative estimated otter population. Surveys by TPWD (1998, 2003) have found that the otter populations have remained fairly stable, a good indicator that the population suffered no ill-effects attributable to that season's harvest. The harvest level negatively impacting the otter population is unknown, but is probably at least above 30%. At that point, the population would likely begin to decline, based on otter reproduction capabilities and mortality factors. Therefore, it is concluded that TWSP and cumulative take had a low magnitude impact on the otter population in Texas. Cumulative take, under the realistic population estimate of 17,000, could be 5,100 if 30% were a realistic harvest level for otters. Take would have to increase almost five-fold before this were reached.

4.2.1.2 Alternative 2 - Technical Assistance Only. Under this alternative, TWSP would have no impact on target aquatic mammal populations directly. Other governmental or private entities may probably provide nearly the same level of direct control assistance with AMDM, but without TWSP assistance. Private efforts to reduce or prevent damage could increase possibly resulting in increased negative impacts on those populations. For the same reasons shown in the population impacts analysis in section 4.2.1.1, it is highly unlikely that aquatic mammal populations would be impacted significantly by implementation of this alternative. Impacts and hypothetical risks of illegal chemical toxicant use under this alternative would probably be about the same or less than those under Alternative 2.

4.2.1.3 Alternative 3 - Nonlethal AMDM Only. Under this alternative, TWSP would not take target aquatic mammal species. TWSP would provide support with nonlethal AMDM tools and would be able to provide dome support. However, because TWSP would likely be ineffective in many damage situations, funds legislatively provided to TWSP for AMDM would likely be reallocated to another state agency to conduct an AMDM program similar to the current program. Impacts on target species under this alternative

could be the same, less, or more than those of the proposed action depending on the level of effort expended by other governmental agencies and private persons. For the same reasons shown in the population impacts analysis in section 4.2.1.1 it is highly unlikely that aquatic mammal populations would be impacted significantly by implementation of this alternative. It is hypothetically possible that frustration caused by the inability to reduce losses could lead to illegal use of methods and chemical toxicants which could lead to unknown impacts on aquatic mammals, but these would only likely impact populations in small areas.

4.2.2 Effects on Nontarget Species Populations, Including T&E Species

4.2.2.1 Alternative 1 - Continue the Current TWSP AMDM Activities. Nontarget species taken in Texas are recorded as Target - Unintentional (i.e., they were listed on the agreement as target species, but were taken unintentionally during efforts to take other target species) or Nontarget (i.e., they were not listed as target species on the agreement and were taken unintentionally during efforts to take target species). TWSP personnel try to minimize the take of nontargets by placing traps in areas conducive to trapping only target animals, in addition to using appropriate traps and lures likely to attract primarily target animals. However, nontargets are occasionally taken in AMDM, but is typically below 5% of animals taken. In FY01, nontarget take did exceed 5%, averaging just over 6%. TWSP took 111 nontargets in FY00, 253 in FY01, and 271 in FY02 (Table 5). Species taken most frequently as nontargets, included: turtles, otter, nutria, and raccoons (*Procyon lotor*). Turtle take is discussed below. Nontarget take of otter and nutria were discussed in impacts to targets in Section 4.2.1.1 and found to be insignificant. Raccoon take is also insignificant because raccoon represents the top furbearer harvested. An average of 12 nontarget raccoons is only a small fraction of the 36,000 taken by fur harvesters in the 2001-02 season. Raccoon take was 132,000 in the 1997-98 season, therefore, TWSP concludes that the average take of 12 raccoons is of low impact.

Other species have been taken, but at levels clearly seen as insignificant in terms of their overall population. All species taken are common and abundant. Species taken in the last 3 FYs include: nine-banded armadillo (*Dasypus novemcinctus*), beaver, opossum (*Didelphis virginianus*), double-crested cormorant (*Phalacrocorax auritus*), great blue heron (*Ardea herodias*), American alligator (*Alligator mississippiensis*), and a carp (*Cyprinus carpio*). The potential does exist for TWSP to take other nontargets that could be seen as significant; a nontarget T&E species would cause the greatest concern, but TWSP has not taken a T&E species in AMDM.

Table 5 Take of nontarget species in Texas by TWSP while conducting AMDM in FY00, FY 01, and FY02.

Nontarget Species Taken by TWSP during AMDM from FY00 to FY02				
Species	**FY00**	**FY01**	**FY02**	**Ave.**
Armadillo	1	-	-	0.3
Beaver	-	-	2	0.7
Nutria	21	17	14	17.3
Otter	63	57	86	68.7
Opossum	1	2		1.0
Raccoon	15	10	10	11.7
Double-crested Cormorant	1	5	2	2.7
Great Blue Heron	-	-	1	0.3
Alligator	-	1	3	1.3
Turtle Spp.	79	160	153	107.3
Fish Spp.	-	1	-	0.3
TOTAL	111	253	271	211.7

Turtle Populations Impact Analyses Turtles comprise the highest nontarget take by TWSP in AMDM activities. TWSP took an average of 212 turtles statewide for FY00 to FY02. For comparison, Oklahoma commercial harvesters typically took 50,000 turtles in 1996 (Okla. Dept. Wildl. Cons. 1997) suggesting the harvest potential for Texas would be much higher. Turtles are not protected in Texas with the exception of T&E species, and, thus, can be taken by any individual. The most common species taken by TWSP incidental to AMDM are: red-eared turtles (*Trachemys scripta*), river cooter (*Pseudemys concinna*), smooth (*Apalone mutica*) and spiny softshell turtles (*A. spinifera*), and common snapping turtles (*Chelydra serpentina*). One State threatened species is found in the range of aquatic mammals in central Texas, the Cagle's map turtle (*Graptemys caglei*), but AMDM is rarely conducted in its range, nor have been taken. It is unknown how many of each turtle species TWSP takes because records are not kept for turtles by species, especially as they are unprotected species in Texas. The level of take by TWSP, though, is insignificant in terms of the overall populations of these and all other turtles in Texas. Therefore, TWSP impacts to turtle populations are considered insignificant in terms of the overall population.

T&E Species. AMDM in Texas under the current program, Alternative 1, would have minimal potential impacts on T&E species or their habitat. Federally listed T&E species in Texas include: 16 mammal, 16 bird, 9 reptile, 4 amphibian, 10 fish, 21 invertebrate, and 29 plant species. To assess species impacts and/or methods not covered by the 1992 BO or pending formal Section 7 consultations, TWSP prepared a biological assessment (BA) in 1998. It was submitted to USFWS in conjunction with an informal Section 7 consultation request. The USFWS concurred that the activities proposed herein are not likely to adversely affect any listed T&E species, with the possible exceptions of the ocelot, jaguarundi, and Houston toad. USFWS has offered mitigating procedures to avoid impacts to these species, which WS has accepted and incorporated. The TWSP has not taken any T&E species in the State, and does not expect taking any under the current program.

In making "may effect" determinations for methods used by WS in the 1992 BO, the USFWS made no such determinations for any listed fish, invertebrate, or plant species. The methods considered in the 1992 BO include those used by the TWSP for managing aquatic mammal damage with the exception of beaver dam removal by mechanical means and explosives. Therefore, TWSP has determined that the methods used by the program to capture or take aquatic mammals will not affect any listed fish, invertebrate, or plant species that may occur in the State. In addition, TWSP concluded that those methods would likewise have no effect on three salamander species, five resident sea turtle species, or the Concho water snake in a 1998 Biological Assessment.

Listed mammal species include the Mexican long-nosed bat (*Leptonycteris nivalis*), Louisiana black bear (*Ursus americanus luteolus*), West Indian manatee (*Trichechus manatus*), jaguarundi, and ocelot. West Indian manatee may reside in larger drainages that empty into large saltwater bays and lakes or the Gulf of Mexico. Since they require relatively deep water to live, it is unlikely that beaver management activities conducted by TWSP will have any impact on this species. The 1992 BO determined that TWSP actions would not affect bats and that the only methods that may adversely affect the ocelot and jaguarundi are leghold traps, snares, and M-44 devices (sodium cyanide ejectors) used in predator control. The 1999 Section 7 consultation letter from USFWS has requested that similar mitigating measures, in effect for predator control work in areas of the ocelot and jaguarundi habitat, be enacted for AMDM within the same areas of concern. WS has agreed, and similar mitigating measures are currently in place.

Listed reptiles include five sea turtles, American alligator (*Alligator mississippiensis*), Cagle's map turtle (*Graptemys caglei*), and Concho water snake (*Nerodia paucimaculata*). American alligator is listed as "threatened by similarity of appearance" for purposes of protecting the American crocodile (*Crocodylus*

acutus), occurring only in Florida. TPWD monitors alligator population levels and controls annual harvest by permit restrictions.

WS has requested formal consultation under section 7 of the ESA to address potential impacts on the Mexican Spotted Owl (*Strix occidentalis*) and southwestern willow flycatcher (*Empidonax traillii extimus*). TWSP will abide by any Reasonable and Prudent Alternatives that result from that consultation. Of the other listed bird species, only the bald eagle (*Haliaeetus leucocephalus*) may potentially be affected by WS activities and was covered by the 1992 BO. TWSP follows reasonable and prudent alternatives and measures and abides by terms and conditions established in the 1992 BO to avoid adverse impacts to the bald eagle and other listed species (see Appendix F of the FEIS). In FY 00, 62% of all beaver requests were for protection of irrigation structures and an additional 17% were for protection of man-made resources (houses, landscaping, and roads). These cases involve artificial habitats not conducive to T&E species. Mitigation or minimizing measures that serve to avoid adverse impacts on T&E species were described in Chapter 3 (section 3.4.2.2). Those measures should assure that the proposed action would not adversely impact T&E species. TWSP did address T&E impacts in its 1998 BA to the USFWS. The BA lists Texas's state and federally listed T&E species and discusses minimizing measures to reduce potential impacts to these species. USFWS and TPWD have concurred that TWSP AMDM activities will either not affect or are not likely to adversely affect any federal or state listed T&E species in Texas.

4.2.2.2 Alternative 2 - Technical Assistance Only. Alternative 2 would not allow any TWSP direct operational AMDM in the area. There would be no impact on nontarget or T&E species by TWSP activities from this alternative. Technical assistance or self-help information would be provided at the request of resource owners and others. Although technical support might lead to more selective use of control methods by private parties, private efforts to reduce or prevent damage could result in less experienced persons implementing control methods, including the hypothetical illegal use of toxicants, leading to greater take of nontarget wildlife and T&E species. Hazards to nontargets could therefore be greater under this alternative. It is hypothetically possible that frustration caused by the inability to reduce losses could lead to illegal use of chemical toxicants which could impact local nontarget species populations, including T&E species.

4.2.2.3 Alternative 3 - Nonlethal AMDM Only. Under this alternative, TWSP' nontarget take would probably be minimal and less than that of the proposed action, because fewer lethal control actions would be taken. In addition, aquatic mammals could relocate during the time that it would take to implement control techniques. Mitigation measures to avoid T&E impacts were described in Chapter 3. Those measures should assure that adverse impacts are not likely to occur to T&E species by implementing Alternative 3. However, if cooperators were not satisfied by corrective control operations by TWSP, private efforts to reduce or prevent depredations could increase, similar to Alternative 2. This could result in less experienced persons implementing control methods including the hypothetical use of illegal toxicants and could lead to greater take of nontarget wildlife than the proposed action.

4.2.3 Humaneness of Control Techniques

4.2.3.1 Alternative 1 - Continue the Current TWSP AMDM Activities. Under this alternative, methods viewed by some persons as inhumane would be employed. Despite SOPs designed to maximize humaneness as described in sections 3.4.2.3 and 2.2.2, the perceived stress and trauma associated with being held in leghold traps or snares until the TWSP specialist arrives at the trap or snare site to dispatch the animal, or, as in the case of an unharmed nontarget, to release it, is unacceptable to some persons. In addition, some methods are used in "drown sets" where the animal drowns shortly after being caught which is also considered inhumane by some persons. Other AMDM methods used to take target animals including body-gripping traps (i.e., Conibears®), cage traps with shooting and shooting alone result in a relatively humane

death because the animals die instantly or within seconds to a few minutes; over 95% of the aquatic mammals taken by TWSP in Texas were with these methods from FY00 to FY02.

Some people are concerned about the humaneness of drowning aquatic mammals while restrained by leghold traps or snares. Considerable debate and disagreement among animal activists, veterinarians, wildlife professionals, fur trappers, and nuisance wildlife specialists is apparent. However, use of drowning trap sets has been a traditional wildlife management technique in trapping aquatic mammals. Trapper education manuals or other wildlife damage management manuals written by wildlife biologists recommend drowning sets for leghold traps (Howard et al. 1980, Randolf 1988, Bromley et al. 1994, Dolbeer et al. 1994, Miller and Yarrow 1994). In some situations, drowning trap sets are the most appropriate and efficient method available to capture aquatic mammals. Animals that drown die relatively quickly (e.g., within minutes) versus the possible stress of being restraining and harassed by people, dogs, and other wildlife before being euthanized. Drowning sets make the captured animal and trap less visible and prevent injury (i.e., scratches and bites) to people who may otherwise approach a restrained animal. Furthermore, some people are offended seeing dead animals ans drowning sets take dead animals out of the public's view.

Given the short time period of a drowning event, possible analgesic effect of CO_2 buildup, minimum, if any, pain or distress on the drowning animal, the AVMA's acceptance of hypoxemia as euthanasia, AVMA's acceptance of a minimum of pain and distress during euthanasia, and acceptance of catching and drowning as approved by International Humane Trapping Standards, the conclusion has been drawn that drowning is acceptable.

4.2.3.2 Alternative 2 - Technical Assistance Only. Under this alternative, TWSP would not use leghold and quick-kill traps, cage traps, snares, and shooting. Use of such methods by private individuals and other state agencies would probably increase. This could result in less experienced persons implementing use of traps and snares without modifications such as pan tension devices which exclude smaller nontarget animals from leghold traps. Greater take and suffering of nontarget wildlife could result, however, technical assistance would be available from TWSP providing better training for the general public on the appropriate procedures for using different methods.. It is hypothetically possible that frustration caused by the inability to reduce losses could lead to illegal use of chemical toxicants which might result in increased animal suffering.

4.2.3.3 Alternative 3 - Nonlethal AMDM Only. The amount of suffering by target and nontarget wildlife taken in AMDM by TWSP under this alternative would likely be less than under the proposed action since preventive control activity by TWSP would not be allowed. However, use of leghold traps and shooting by private individuals would probably increase if depredation was not satisfactorily reduced. This could result in similar impacts as Alternative 2, although they would likely be less severe. The hypothetical risk of frustration leading to illegal pesticide use and its associated animal suffering is probably less than under Alternative 2, but more than under the proposed action.

4.2.4 Effects of Beaver Dam Removal on Wetland Wildlife Habitat

4.2.4.1 Alternative 1 - Continue the Current TWSP AMDM Activities. Under this alternative, beaver impounded areas would be removed by hand or with explosives for the purpose of returning streams, channels, dikes, culverts, and irrigation canals to their original function. TWSP removed 20 dams with explosives in FY00, 5 in FY01, and 10 in FY02 because the beaver impoundments flooded merchantable timber, roads, pastures, and rangeland. Other areas where dams may be removed include mostly property or resources that were not previously flooded. The majority of complaints addressed by TWSP (Table 1a) combining data from FY 00 through FY02 involved damage to irrigation ditches, dikes, roads, bridges,

croplands, and urban property where "wetlands" would not be involved because these properties only recently were flooded. The dams removed were almost invariably created as a result of recent beaver activity because TWSP personnel receive most requests soon after affected resource owners discover damage or become aware of the TWSP program. Dams are removed in accordance with exemptions from permit requirements established by regulation or as allowed under NWPs granted under Section 404 of the Clean Water Act (see Sections 2.2.3 and 3.2.1). The majority of impoundments removed by TWSP have only been in existence for a few weeks or months. These are not considered true wetland habitats and, therefore, do not possess the same wildlife habitat values that established wetlands have and these dams can be removed. The terrestrial habitat and wetland existing prior to the establishment of the beaver dam are restored following the removal of a newly established dam.

From FY00 to FY02, TWSP removed 35 dams with binary explosives, averaging 12 dams annually in Texas. Considering the acreage of wetlands in Texas, this would be minimal in terms of percent because the majority of beaver dams removed by WS have less than a surface acre or two of water held in them. In addition, as discussed, these are not "wetlands." Thus, significant impacts on established wetland wildlife habitat are avoided. Therefore, it is concluded that WS has no impact on wetland wildlife habitat.

4.2.4.2 Alternative 2 - Technical Assistance Only. Under this alternative, TWSP would not remove beaver dams, but would be available to offer necessary referral information for landowner compliance with legal obligations pertaining to wetlands. The need for beaver dam removal would likely be met by private, state, or local government entities, however, WS has a blaster certification program which would not be accessible to these other entities. Therefore, it is reasonable to assume that some beaver impounded areas might be drained under private or governmental management that TWSP would have advised against draining, possibly resulting in adverse habitat impacts in limited circumstances. Private landowners frustrated with a lack of responsiveness may attempt to remove dams on their own by hand, with heavy equipment, or by means not environmentally sound.

4.2.4.3 Alternative 3 - Nonlethal AMDM Only. Reduced effectiveness might cause local governments and individuals to drop out of federally supervised AMDM programs, but this would be less likely than under Alternative 2. There would be an increase in AMDM and dam removal by state agencies and by less trained and less experienced private individuals. The potential for adverse impacts to wetlands would be slightly more than the current program but less than under Alternative 2.

4.2.5 Effects of AMDM Methods on Public Safety

4.2.5.1 Alternative 1 - Continue the Current TWSP AMDM Activities. Some AMDM methods could pose risks where they are not used by professionals. Methods used in AMDM that could present the highest risks are the use of explosives, firearms, Conibear® traps, leghold traps, snares, and zinc phosphide. However, no accidents resulting in harm to any persons have occurred under the current program.

TWSP uses binary explosives to remove beaver dams. TWSP Specialists who use explosives are certified through in-depth training and must be able to demonstrate competence and safety in their use of explosives. They adhere to WS policies as well as regulations with regards to explosives use, storage, and transportation from the Bureau of Alcohol, Tobacco, Firearms, and Explosives, Occupational Safety and Health Administration, and Department of Transportation. Binary explosives require two components to be mixed before they can be actuated which virtually eliminates the hazard of accidental detonation during storage and transportation. Storage and transportation of mixed binary explosives is not allowed. When explosives are used, signs are placed to deter public entry. In addition to signs, TWSP personnel watch for people, vehicles, and other indicators to ensure no one is present in the vicinity when explosives are used. Where dams are

near roads, police or other road officials stop traffic and public entry. Also, TWSP personnel that use explosives attend recertification programs. Therefore, no adverse impacts to public safety are expected from the use of explosives by TWSP in Texas. Risks to employees are minimized through safety training and certification.

TWSP personnel use firearms to take aquatic mammals and euthanize animals caught in traps. TWSP personnel are trained and given refresher courses to maintain awareness of firearm safety and handling as prescribed by WS policy. Therefore, no adverse impacts to public safety are expected from the use of firearms by TWSP in Texas.

TWSP uses traps (e.g. body-gripping traps [Conibear®], leghold traps, and snares) to take target aquatic mammals. Traps are strategically placed to minimize nontarget take and minimize exposure to the public and pets. Signs are used to post properties where traps are set to alert the public of their presence. In addition, body-gripping traps are restricted to water sets by WS policy, which further reduces threats to public safety and nontarget take. From FY00 to FY02, beaver take with quick-kill traps averaged 52% of the total beaver take. This shows that while this method is relied upon, TWSP did not have any reportable incidents with the method during the same time period.

Zinc phosphide treated baits are used by some TWSP personnel to control nutria and muskrats. Following label instruction and placing baits on rafts ensures low risks to the public. TWSP personnel that use zinc phosphide are certified through TDA and trained to use the chemicals. From FY00 to FY 02, 17 oz. of zinc phosphide were used to control nutria. This is minimal use for this chemical. No adverse impacts were noted from its use.

Under this alternative, the risk of adverse impacts to the public from AMDM methods would continue to be low as discussed. Risk to members of the public from use of explosives to remove beaver dams, firearms, and body-gripping traps to take aquatic mammals would remain low due to adherence to WS policies, required safety precautions, and training.

4.2.5.2 Alternative 2 - Technical Assistance Only. There would be no potential for adverse impacts to humans from TWSP, since TWSP would be limited to technical assistance. However, other governmental and private entities would likely continue to use AMDM methods, without being restricted by WS' self-imposed policies. Potentially, other entities may not have personnel trained at the level of TWSP, which has national programs for training. Private use of AMDM methods would probably rise, increasing risks to human safety because of lack of training and knowledge of the proper use of AMDM methods. Body-gripping traps can cause injuries to persons who try to use them without proper training. Private persons who use explosives to remove beaver dams are far less likely to be adequately trained in safety or to be held accountable for safe practices. Technical assistance from TWSP could help lessen these risks if individuals request technical assistance and act in accordance with the safety advice given. In addition, the potential exists for illegal activities to occur such as the misuse of poisons, especially from frustrated resource owners that cannot manage damage situations. Public safety risks under this alternative would, therefore, likely increase.

4.2.5.3 Alternative 3 - Nonlethal AMDM Only. Reduced effectiveness of TWSP under this alternative might cause local governments and individuals to drop out of federally supervised AMDM programs and result in similar impacts as described under Alternative 2. However, this would be less likely than under Alternative 2 because some AMDM needs would be met by WS. Risk of adverse impacts to the public from the use of AMDM methods would be greater than the current program, but probably less than Alternative 2.

4.3 ALTERNATIVE IMPACTS

Each of the 4 analyzed Alternatives would have varying impacts in the 6 issue areas. Alternative 1 would probably have the overall lowest impacts on the environment (Table 3). Alternative 2, followed closely by Alternative 3 would probably have the highest impacts to the environment.

Table 3. Alternative Impacts on Issues Compared.

Issues	Alternative 1	Alternative 2	Alternative 3
Target Species	Low	Low	Low
Nontarget Spp.	Low	Low	Low
T&E Species	Low	Low to Moderate	Low to Moderate
Humaneness	Low	Low to Moderate	Low to Moderate
Wetland Habitat	Low	Low to Moderate	Low to Moderate
Public Safety	Low	Low to Moderate	Low to Moderate

CHAPTER 5: LIST OF PREPARERS AND PERSONS CONSULTED

5.1 List of Preparers

Thomas Hall, Wildlife Biologist/Environmental Coordinator, CO, USDA-APHIS-WS.

Bruce Leland, Wildlife Biologist/Asst. State Director, TX, USDA-APHIS-WS.

Gary Littauer, Wildlife Biologist/National Environmental Manager, NM, USDA-APHIS-WS.

Gary Nunley, Wildlife Biologist/State Director, TX, USDA-APHIS-WS.

Denise Ruffino, Wildlife Biologist/Staff Specialist, TX, USDA-APHIS-WS.

Randy Smith, Wildlife Biologist/Staff Specialist, TX, USDA-APHIS-WS.

5.2 List of Persons and Agencies Consulted

Natural Resources Conservation Service, Temple, TX
Gary Valentine - Wildlife Biologist

Texas Parks and Wildlife Department, Austin, TX
John Heron, Branch Chief - Wildlife Diversity Program
Paul Robertson, Program Leader - Wildlife Diversity Program

U.S. Fish and Wildlife Service - Ecological Services, Austin, TX
Bill Seawell - Wildlife Biologist

U.S. Army Corps of Engineers, Ft. Worth District
James Gilmore - Regulatory Officer

5.3 Literature Cited

Andrews, E. J., B. T. Bennett, J. D. Clark, K. A. Houpt, P. J. Pascoe, G. W. Robinson, and J. R. Boyce. 1993. Report of the American Veterinary Medical Association Panel on Euthanasia. J. Amer. Vet. Med. Assoc. 202:229-249.

Arner, D. H. 1964. Research and a practical approach needed in management of beaver and beaver habitat in the southeastern United States. Trans. N. Amer. Wildl. Conf. 29:150-158.

_____, and J. S. Dubose. 1979. The impact of the beaver on the environment and economics in the southeastern United States. Proc. Int. Wildl. Congress. 14:241-247.

_____, and G. R. Hepp. 1989. Beaver pond wetlands: A southern perspective. Pp. 117-128. *In* L. M. Smith, R. L. Pederson, and R. M. Kaminski, eds. Habitat management for migrating and wintering waterfowl in North America. Texas Tech Univ. Press, Lubbock.

American Veterinary Medical Association (AVMA). 1986. Panel report on the colloquium on recognition and alleviation of animal pain and distress. J. Amer. Vet. Med. Assoc. 191:1186-1189.

Avery, E. L. 1992. Effects of removing beaver dams upon a northern Wisconsin brook trout stream. Wisc. Dept. Nat.

Res., Madison.

Beach, R., and W. F. McCulloch. 1985. Incidence and significance of *Giardia lamblia* (Lamblia) in Texas beaver populations. Proc. Great Plains Wildl. Damage Control Workshop. 7:152-164.

Beaver, B.V., W. Reed, S. Leary, B. McKiernan, F. Bain, R. Schultz, B. T. Bennett, P. Pascoe, E. Shull, L.C. Cork, R. Francis-Floyd, K. D. Amass, R. Johnson, R.H. Schmidt, W. Underwood, G. W. Thornton, and B. Kohn. 2001. 2000 report of the American Veterinary Medical Association panel on euthanasia. J. Amer. Vet. Med. Assoc. 218:669-696.

Berryman, J. H. 1991. Animal damage management: responsibilities of various agencies and the need for coordination and support. Proc. East. Wildl. Damage Control Conf. 5:12-14.

Blundell, G. M., J. W. Kern, R. T. Bowyer, and L. K. Duffy. 1999. Capturing river otters: a comparison of Hancock and leg-hold traps. Wildl. Soc. Bull. 27:184-192.

Bomford, M. 1990. Ineffectiveness of a sonic device for deterring starlings. Wildl. Soc. Bull. 18:151-156.

Boutin, S. and D. E. Birkenholz. 1998. Muskrat and round-tailed muskrat. Pp. 282-313. *In* M. Novak, J. A. Baker, M. E. Obbard, B. Mallock, editors. Wild Furbearer Management and Conservation in North America. Revised edition. Minist. Nat. Res., Ontario, Canada. 1150 pp.

Bromley, P. T., J. F. Heisterberg, W. T. Sullivan, Jr., P. Sumner, J. C. Turner, R. D. Wickline, and D. K. Woodward. 1994. Wildlife damage management: beavers. N. Carolina Coop. Ext. Serv., NC.

California Department of Fish and Game (CDFG). 1991. California Department of Fish and Game, Final Environmental Document - Bear Hunting. California Code of Regulations (Title 14, Sections 265, 365, 366, 367, 367.5). California Department of Fish and Game, California.

Center for Disease Control. 1990. Morbidity and Mortality Weekly Report. Compendium of Rabies Control. 39:4-6.

Churchill, J. E. 1980. Beaver are killing our trout streams. Trout. 21:22-25.

Clausen, G., and A. Ersland. 1970. Blood O_2 and acid-base changes in the beaver during submersion. Respiration Physiology. 11:104-112.

Conover, M.R. 1982. Evaluation of behavioral techniques to reduce wildlife damage. Proc. Wildl – Livestock Relation Symp. 10:332-344

DeAlmeida, M. H. 1998. Nuisance furbearer damage control in urban and suburban areas. Pp. 996-1006. *In* M. Novak, J. A. Baker, M. E. Obbard, B. Mallock, editors. Wild Furbearer Management and Conservation in North America. Revised edition. Minist. Nat. Res., Ontario, Canada. 1150 pp.

Decker, D. J., and G. R. Goff. 1987. Valuing Wildlife: Economic and Social Perspectives. Westview, Boulder, Colorado.

Dolbeer, R. A., N. R. Holler, and D. W. Hawthorne. 1994. Identification and control of wildlife damage. Pp. 474-506. *In* T. A. Bookhout, ed. Research and Management Techniques for Wildlife and Habitats. Wildl. Soc., Bethesda, Maryland.

_____, P. P. Woronecki, and R. L. Bruggers. 1986. Reflecting tapes repel blackbirds from millet, sunflowers, and sweet corn. Wildl. Soc. Bull. 14:418-425.

Eccleston, C. 1995. Determining when an analysis contains sufficient detail to provide adequate NEPA coverage. Federal Facilities Environmental Journal, Summer. p. 37-50.

Evans, J. 1970. About nutria and their control. Bur. Sport Fisheries & Wildl., Denver Wildl. Res. Cen. 86:1-65.

Forbus, K., and F. Allen. 1981. Southern beaver control. Georgia For. Res. Paper 23.

Gilbert, F. F., and N. Gofton. 1982. Terminal dives in mink, muskrat, and beaver. Physiol. and Beh. 28:835-840.

Gracely, R. H., and W. F. Sternberg. 1999. Athletes: pain and pain inhibition. American Pain Soc. 9:1-8.

Graves, G. E., and W. F. Andelt. 1987. Prevention and control of woodpecker damage. Service in Action, Colo. St. Univ. Coop. Ext. Serv. Publ. 6.516. Ft. Collins, CO. 2 pp.

Hill, E. P. 1976. Control methods for nuisance beaver in the southeastern United States. Proc. Vert. Pest Control Conf. 7:85-98.

_____. 1982. Beaver. pp. 256-281. *In* J. A. Chapman and G. A. Feldhamer, eds. Wild Mammals of North America: Biology, Management, Economics. John Hopkins Univ., Baltimore, MD.

_____. 1994. River otters. pp C-109-112. *In* S. E. Hygnstrom, R. M. Timm, and G. E. Larson, eds. Prevention & Control of Wildlife Damage. Vol. I. Univ. Nebr., Great Plains Agric. Council Wildl. Comm., and USDA-APHIS-WS, Wash., D.C.

_____, D. N. Lasher, and R. B. Roper. 1977. A review of techniques for minimizing beaver and white-tailed deer damage in southern hardwoods. Proc. Symp. Southeastern Hardwoods. 2:79-93.

Howard, R., L. Berchielli, G. Parsons, and M. Brown. 1980. Trapping Furbearers: Student Manual. Dept. Cons., New York, NY.

Jackson, S., and T. Decker. 1993. Beavers in Massachusetts. Univ. Mass. Coop. Ext. System, Amhurst, MA.

Jones, J., and B. D. Leopold. 2001. Herbivorous furbearers. Pp 293-308. *In* Dickson, ed., Wildlife Management of Southern Forests: Habitats and Management. Hancock House, Blaine, Washington.

Kinler N., G. Linscombe, and P. R. Ramsey. 1998. Nutria. Pp. 326-343. *In* M. Novak, J. A. Baker, M. E. Obbard, B. Mallock, editors. Wild Furbearer Management and Conservation in North America. Revised edition. Minist. Nat. Res., Ontario, Canada. 1150 pp.

Kolz, A.L. and R.E. Johnson. 1997. In-water electro-shock techniques to repel aquatic mammals and birds. Pp. 203-215. *In*: J.R. Mason, ed. Repellents in Wildlife Management. Symp. Proc. Aug. 8-10, 1995 Denver & Ft. Collins , CO. USDA, APHIS, WS, Nat. Wildl. Res. Cen.

Laramie, H. A., Jr., and S. W. Knowles. 1985. Beavers and Their Control. University of New Hampshire Cooperative Extension Service, Durham, New Hampshire.

Latham, R. M. 1960. Bounties Are Bunk. Nat. Wildl. Federation, Wash., D.C. 10 pp.

LeBlanc, D. J. 1994. Nutria. pp B-71-80. *In* S. E. Hygnstrom, R. M. Timm, and G. E. Larson, eds. Prevention & Control of Wildlife Damage. Vol. I. Univ. Nebr., Great Plains Agric. Council Wildl. Comm., and USDA-APHIS-WS, Wash., D.C.

Leopold, A. S. 1933. Game Management. Charles Scribner & Sons, New York, NY. 481 pp.

Lisle, S. 1996. Beaver deceivers. Wildl. Control Techn. 5:42-44.

Loeb , B. F., Jr. 1994. The beaver of the old north state. Pop. Govt. 18-23.

Loven, J. E. 1985. Reported beaver damage and control methods used in Texas. Proc. Great Plains Wildl. Damage Control Workshop. 7:145-151.

Ludders, J. W., R. H. Schmidt, F. J. Dein, and P. N. Klein. 1999. Drowning is not euthanasia. Wildl. Soc. Bull. 27:666-670.

Mallis, A. 1982. Handbook of Pest Control. 6th edition. Franzak & Foster Company, Cleveland, OH.

Melquist, W. E. and A. E. Dronkert. 1998. River otter. Revised. Pp. 626-641. *In* M. Novak, J. A. Baker, M. E. Obbard, B. Mallock, editors. Wild Furbearer Management and Conservation in North America. Revised edition. Minist. Nat. Res., Ontario, Canada. 1150 pp.

Miller, J. E. 1994. Muskrats. pp. B-61-70. *In* S. E. Hygnstrom, R. M. Timm, and G. E. Larson, eds. Prevention & Control of Wildlife Damage. Vol. I. Univ. Nebr., Great Plains Agric. Council Wildl. Comm., and USDA-APHIS-WS, Wash., D.C.

_____, and G. K. Yarrow. 1994. Beavers. pp. B-1-11. *In* S. E. Hygnstrom, R. M. Timm, and G. E. Larson, eds. Prevention & Control of Wildife Damage. Vol. I. Univ. Nebr., Great Plains Agric. Council Wildl. Comm., and USDA-APHIS-WS, Wash., D.C.

Minnesota Department of Natural Resources. 1994. The Clemson beaver pond leveler. Minn. Dept. Nat. Res., St. Paul.

Mott, D. F. 1985. Dispersing blackbird-starling roosts with helium-filled balloons. Proc. East. Wildl. Damage Control Conf. 2:156-162.

Naimen, R. J., J. M. Melillo, and J. E. Hobbie. 1986. Ecosystem alteration of boreal forest streams by beaver (*Castor canadensis*). J. Ecol. 67:1254-1269.

Natural Resources Conservation Service (NRCS). 1994. Texas Tables: 1992 National Reources Inventory. Temple, TX.

Neves, R. J., and M. C. Odom. 1989. Muskrat predation on endangered freshwater mussels in Virginia. J. Wildl. Manag. 53:934-941.

Nolte, D. L., M. W. Lutman, D. L. Bergman, W. M. Arjo, and K. R. Perry. 2003. Feasibility of nonlethal approaches to protect riparian plants from foraging beaver in North America. Pp. 75-79. *In* G. A. Singleton, L. A. Hinds, C. J. Krebs, and D. M. Spratt, eds. Rats, Mice, and People: Rodent Biology and Management. Australian Centre Int. Agric. Res., Canberra, Australia.

Nolte, D. L., S. R. Swafford, and C. A. Sloan. 2000. Survey of factors affecting the success of Clemson beaver pond levelers installed in Mississippi by Wildlife Services. Proc. Wildl. Damage Manag. Conf. 9:120-125.

Noonan, B. 1998. The Canadian terminal dive study. Wildl. Control Techn. 3:24-26.

Novak, M. 1998a. Beaver. Pages 282-312 *In* M. Novak, J. A. Baker, M. E. Obbard, B. Mallock, editors. Wild Furbearer Management and Conservation in North America. Revised edition. Minist. Nat. Res., Ontario, Canada. 1150 pp..

_____. 1998b. Traps and trap research. Pages 941-969 *In* M. Novak, J. A. Baker, M. E. Obbard, B. Mallock, editors. Wild Furbearer Management and Conservation in North America. Revised edition. Minist. Nat. Res., Ontario, Canada. 1150 pp.

Oklahoma Department of Wildlife Conswervation. 1997. Oklahoma commercial fishery statistics. 1996 Ann. Rep. ODWC. 13 pp.

Organ, J. F., T. Decker, J. DiStefano, K. Elowe, P. Rego, and P.G. Mirick. 1996. Trapping and furbearer management: Perspectives from the Northeast. U. S. Fish & Wildl. Serv., Hadley, MA.

Patterson, D. 1951. Beaver - trout relationships. Invest. Rep. 822. Wisc. Cons. Dept., Madison, WI.

Pfeifer, W. K., and M. W. Goos. 1982. Guard dogs and gas exploders as coyote depredation control tools in North Dakota. Proc. Vertebr. Pest Conf. 10:55-61.

Pimentel, D., L. Lach, R. Zuniga, D. Morrison. 2000. Environmental and economic costs associated with non-indigenous species in the United States. Bioscience. 50: 53-65.

Ramos, M. G. 1999. Texas Environmental Almanac. *The Dallas Morning News*, L.P., Dallas, TX.

Randolph, J. P. 1988. Virginia Trapper's Manual. Dept. Game & Inland Fisheries, Richmond, VA.

Reese. K. P., and J. D. Hair. 1976. Avian species diversity in relation to beaver pond habitats in the Piedmont region of South Carolina. Proc. Ann. Conf. SE Assoc. Fish & Wildl. Agencies. 30:437-447.

Roblee, K. J. 1983. A wire mesh culvert for use in controlling water levels at nuisance beaver sites. Proc. Eastern Wildl. Damage Control Conf. 1:167-168.

_____. 1984. Use of corrugated plastic drainage tubing for controlling water levels at nuisance beaver sites. New York Fish and Game J. 31:63-80.

_____. 1987. The use of T-culvert guard to protect road culverts from plugging damage by beavers. Proc. Eastern Wildl. Damage Control Conf. 3:25-33.

Rossbach, R. 1975. Further experiences with the electroacoustic method of driving starlings from their sleeping areas. Emberiza. 2:176-179.

Schmidt, R. H. 1989. Animal welfare and wildlife management. Trans. N. Amer. Wildl. & Nat. Res. Conf. 54:468-475.

_____, and R. J. Johnson. 1984. Bird dispersal recordings: an overview. ASTM STP 817. 4:43-65.

Seton, E. T. 1937. Great Historic Animals. Charles Scribner's Sons, New York, NY. 320pp.

Shirota, Y. M., M. Sanada, and S. Masake. 1983. Eyespotted balloons are a device to scare gray starlings. Appl. Ent. Zool. 18:545-549.

Slate, D. A., R. Owens, G. Connolly, and G. Simmons. 1992. Decision making for wildlife damage management. Trans. N. Amer. Wildl. & Nat. Res. Conf. 57:51-62.

Texas Agricultural Extension Service. 1998. The Wetland and Coastal Resources Information Manual. 2nd edtion. K. L. Terry, W. E. Cohen, and D. W. Bauer, eds. Texas Agric. Esxt. Service., Corpus Christi, TX. 2 Vols.

Texas Parks and Wildlife Department (TPWD). 1998. Small game and furbearers research and surveys. Proj. No. 11, Fur-bearing Animal Regulations/Evaluation of Annual Fur Harvest. Fed .Aid Grant No. W-126-R-6. TPWD. 12 pp.

_____. 2003. Small game and furbearers research and surveys. Proj. No. 11, Fur-bearing Animal Regulations/Evaluation of Annual Fur Harvest. Fed .Aid Grant No. W-126-R-10. TPWD. 22 pp.

Tobin, M. E, P. P. Woronecki, R. A. Dolbeer, and R. L. Bruggers. 1988. Reflecting tape fails to protect ripening blueberries from bird damage. Wildl. Soc. Bull. 16:300-303.

U. S. Department of Agricutlure (USDA). 1997. Animal Damage Control Program [*Wildlife Services*] Final Environmental Impact Statement and Record of Decision. USDA-APHIS, Hyattsville, MD.

_____. 1999. USDA, Animal and Plant Health Inspection Service, Wildlife Services Strategic Plan. APHIS, Operational Support Staff, Hyattsville, Maryland.

Wade, D. A., and C. W. Ramsey. 1986. Identifying and Managing Aquatic Rodents in Texas: Beaver, Nutria and Muskrats. Texas Agric. Ext. Serv., Texas A&M University, College Station, TX.

Wayland, R. H., III, and E. V. Shaeffer. 1997. Corps of Engineers/Environmental Protection Agency guidance regarding regulation of certain activities in light of American Mining Congress vs. Corps of Engineers. EPA. Mem. issued April 11, 1997.

Weaver, K. M., D. H. Arner, C. Mason, and J. J. Hartley. 1985. A guide to using snares for beaver capture. Southern J. Applied Forestry. 9:141-146.

Wesley, D. E. 1978. Beaver control in the Southeastern United States. Proce. . Symp. . SE Hardwoods. 6:84-91.

Wigley, T. B., Jr. 1981. A model of beaver damage and control. Dissertation, Miss. State Univ., Mississippi State, MS.

Wildlife Services (WS). 1998. Aquatic rodent damage management in Oklahoma. Environmental Assessment, Finding of No Significant Impact, and Record of Decision. USDA-APHIS-WS, Oklahoma City, OK. 58 pp.

_____. 2003. North Carolina beaver management assistance program. 10th Ann. Rep. USDA-APHIS-WS, NC Dept. Transp., and NC Wildl. Resource Comm. Raleigh, NC. 17pp.

Wildlife Society, The. 1992. Conservation policies of The Wildlife Society: A stand on issues important to wildlife conservation. Wildl. Soc., Bethesda, MD.

Willging, B. and R. Sramek. 1989. Urban beaver damage and control in Dallas-Fort Worth, Texas. Proc. Great Plains Wildl. Damage Cont. Work. 9:77-80.

Wood, G. W., L. A. Woodward, and G. K. Yarrow. 1994. The Clemson beaver pond leveler. Clemson Coop. Ext. Serv., Clemson, SC.

Woodward, D. K. 1983. Beaver management in the southeastern United States: a review and update. Proc. Eastern Wildl. Damage Control Conf. 1:163-165.